DOCUMENT RESUME

ED 234 271 CE 037 091

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TITLE	Elementary School Industrial Arts. ESIA Lesson Plans and Resources for Elementary Classroom Teachers and Industrial Arts Consultants.
INSTITUTION	Pennsylvania State Dept. of Education, Harrisburg.
PUB DATE	83
CONTRACT	04-2002
NOTE	122p.; For a related document, see CE 037 092.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	Audiovisual Aids; Behavioral Objectives; Career Awareness; *Educational Resources; Elementary Education; Equipment; Hand Tools; *Industrial Arts; *Integrated Activities; Interdisciplinary Approach; *Learning Activities; Lesson Plans; State Curriculum Guides; *Student Projects; *Teaching Methods
IDENTIFIERS	Pennsylvania

ABSTRACT

This handbook contains 17 teacher-developed elementary school industrial arts (ESIA) lesson plans and a bibliography of resources to assist in planning additional lessons. The handbook supplements an ESIA curriculum guide used in Pennsylvania. Each plan contains the name of the activity, its purpose, a drawing or photograph of the product, a work drawing, behavioral objectives, lists of applications and of skills to be acquired through the project, tools and equipment, materials needed, safety considerations, career awareness, the procedure for conducting the project, and a final suggestion by the writer of the lesson plan. The following projects are described in the lesson plans: words under construction in wood, jigsaw puzzles, a leather pouch, a musical instrument, relief painting, Indian rhythms, mass production of a bookmark, a pocket flashlight, metal tooling and transportation, a photogram, an abacus, puppets and a puppet stage, model rockets, bookbinding, learning about electricity, a telegraph, and teaching proportions. The handbook also contains a chart indicating the scope and sequence for each plan and its correlation with the goals of quality education and Pennsylvania's plan for industrial arts. A blank lesson plan, a resource list, and a list of audiovisual aids complete the manual. (KC)

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ED234271

Elementary School Industrial Arts

ESIA Lesson Plans and Resources for Elementary Classroom Teachers and Industrial Arts Consultants

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CE 037091

Contract #04-2002

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Foreword

This handbook contains sample ESIA lesson plans and a bibliography of resources to assist in planning additional lessons. It is a handbook that supplements a curriculum guide titled ESIA: An Educator's Handbook Containing Approaches and Resources for Making the Elementary Education Curriculum More Effective Through Industrial Arts Activities.

As strong advocates of ESIA and teachers who have helped to implement ESIA programs, we cannot under-estimate the importance of becoming familiar with the goals of ESIA which are explained in the above mentioned curriculum guide. ESIA activities in themselves, without an intent to complement language arts, science, mathematics, reading or social studies, can become unstructured play periods that have little educational purpose or meaning.

The sample lesson plans in this handbook have been developed by us, and used successfully. Each sample is identified with the contributor's initials on the last page. Users of this handbook may use the plans immediately or observe how plans are structured for one's own planning purposes. A blank form for writing one's own lessons is provided on pages 113 to 116.

The chart preceding the sample lesson plans indicates the scope and sequence for each plan and its correlation with the goals of a quality education and Pennsylvania's plan for industrial arts. This chart can also be adopted or modified for evaluating strengths, shortcomings and the overall breadth of other lesson plans selected by classroom teachers.

The various activities listed in the Early Childhood Guidelines in Pennsylvania, such as hammering, reading, pushing, sawing, reporting, counting, associating, identifying, comparing, cutting and discovering materials, play a major role in identifying commonalities between the academic areas and the industrial arts activities. These commonalities are listed on each lesson plan under the heading, "Application and Acquisition of Skills." Additionally, the world of work has received major consideration. Specific examples are included under the heading, "Career Awareness."

We hope elementary classroom and industrial arts teachers find this handbook and the curriculum guide useful.

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SCOPE AND SEQUENCE CHART INDICATING AREAS OF EDUCATIONAL REINFORCEMENT FOR SAMPLE LESSON PLANS

ESIA LESSON PLAN	GOALS OF QUALITY EDUCATION												THE PENNSYLVANIA PLAN FOR INDUSTRIAL ARTS (subject areas)																	
	COMMUNICATION SKILLS	MATHEMATICS	SELF ESTEEM	ANALYTICAL THINKING	UNDERSTANDING OTHERS	CITIZENSHIP	ARTS AND THE HUMANITIES	SCIENCE AND TECHNOLOGY	WORK	FAMILY LIVING	HEALTH	ENVIRONMENT	INDUSTRIAL MATERIALS	WOODWORKING	METALWORKING	CERAMICS	PLASTICS	CRAFTS	CONSTRUCTION	MANUFACTURING	VISUAL COMMUNICATIONS	DRAWING/DRAFTING	GRAPHIC ARTS	PHOTOGRAPHY	POWER TECHNOLOGY	ELECTRICITY/ELECTRONICS	POWER MECHANICS	ALTERNATIVE ENERGY SYSTEMS	TRANSPORTATION
WORDS UNDER CONSTRUCTION IN WOOD	X		X										X	X															
JIGSAW PUZZLES			X		X				X	X	X		X	X							X	X							
LEATHER POUCH			X		X								X					X											
MUSICAL INSTRUMENT	X	X	X				X			X			X	X															
RELIEF PRINTING	X							X	X												X		X						
INDIAN RHYTHMS			X		X		X			X			X	X	X														
MASS PRODUCTION OF A BOOKMARK	X	X	X		X	X		X	X	X			X							X									
POCKET FLASHLIGHT	X		X	X	X			X	X				X		X		X				X		X		X	X			
METAL TOOLING AND TRANSPORTATION	X					X						X	X		X			X							X				X
PHOTOGRAM	X		X	X			X		X												X			X					
ABACUS		X	X	X									X	X				X											
PUPPETS AND PUPPET STAGE	X		X	X	X	X				X			X	X															
MODEL ROCKETS		X	X	X				X	X		X		X	X			X								X				X
BOOKBINDING	X		X																		X		X						
LEARNING ABOUT ELECTRICITY		X	X	X				X	X				X	X	X										X	X			
TELEGRAPH	X				X			X																	X	X			
TEACHING PROPORTIONS		X		X				X	X				X	X															

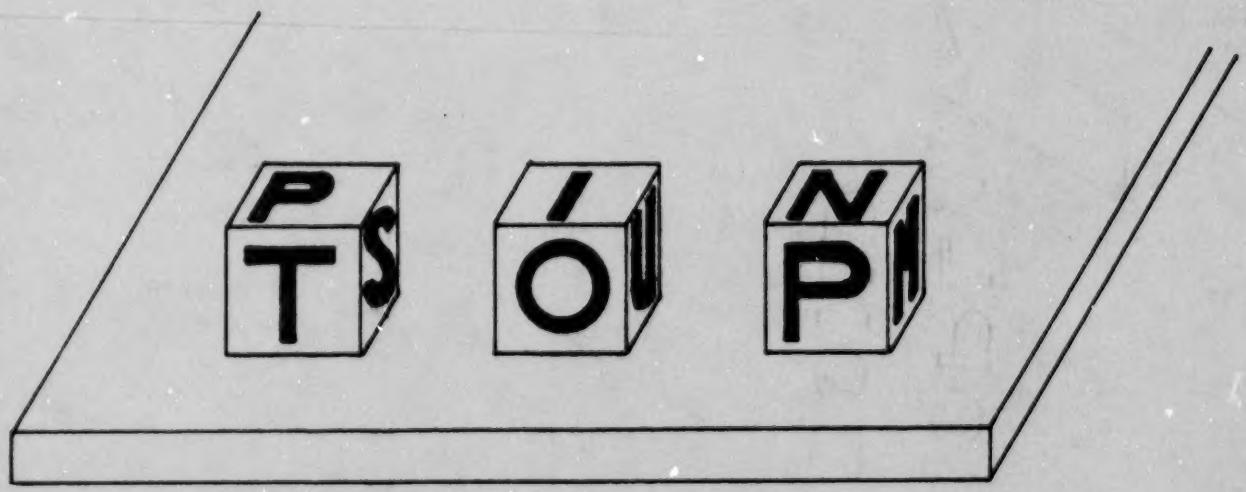
Sample Lesson Plan

I. Name of Activity: Words Under Construction in Wood

II. Purpose of Activity:

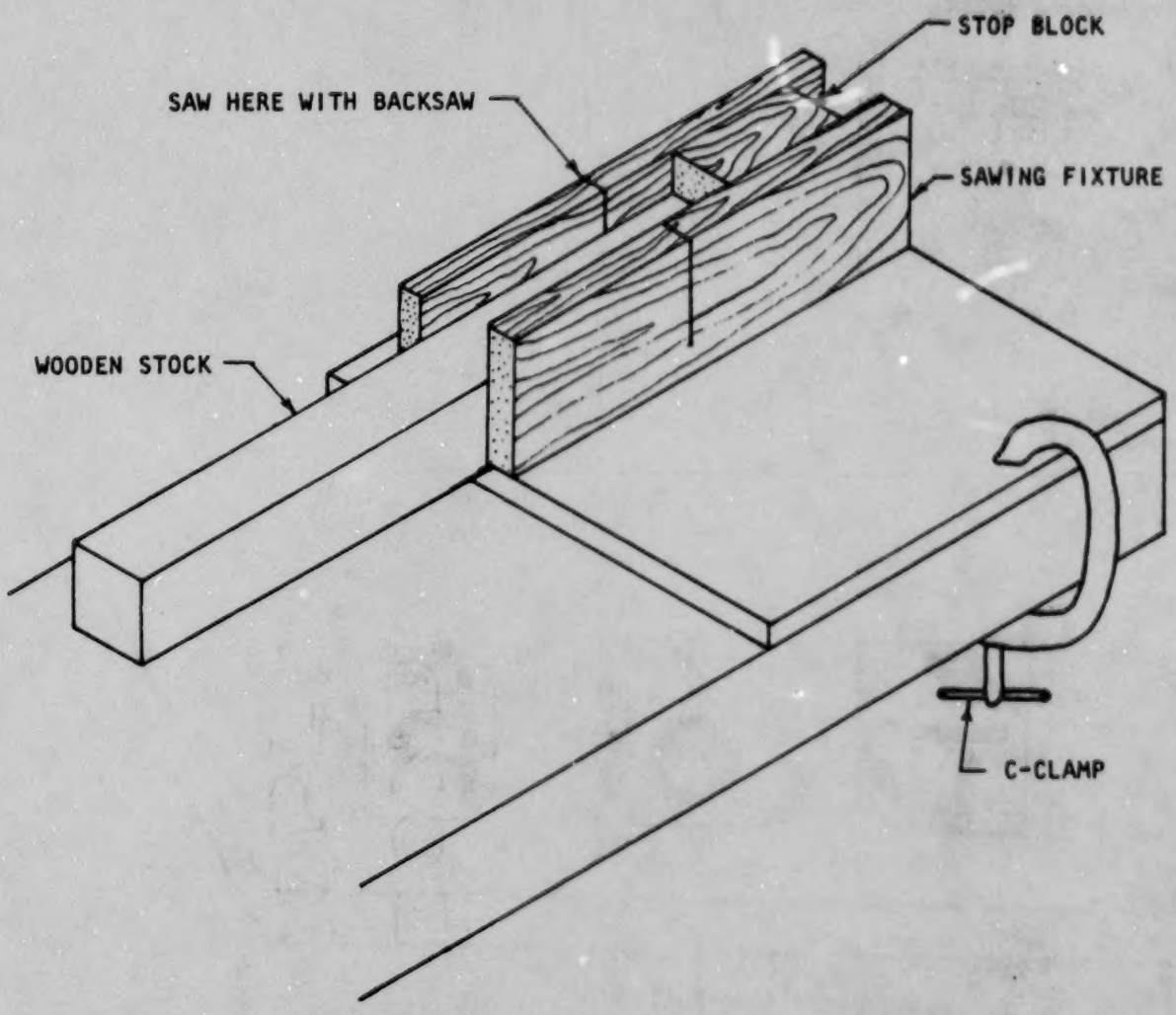
This activity is designed to motivate the students in a primary reading class toward constructive practice in word formation and proper spelling. Such practice will enliven reading for those students who participate in this game.

III. Pictorial Drawing:



WORDS UNDER CONSTRUCTION

IV. Working Drawing:



SAWING FIXTURE CLAMPED TO TABLE TOP OR SAW HORSE

V. Behavioral Objectives:

At the completion of two 45-minute sessions, the students will:

1. Be able to identify such tools as: miter box, c-clamp, back saw and sandpaper.
2. Be able to create words from the letters appearing on randomly tossed blocks.
3. Be able to practice hand lettering the letters of the alphabet on the cubes.
4. Be able to saw a cube by imitating the demonstration of the teacher.
5. Be able to sand her/his cube and label it.
6. Be able to participate in the word construction game.
7. Display a willingness to observe safety rules.
8. Display a willingness to participate in clean-up activities.

VI. Application and Acquisition of Skills:

Fine Motor Training

1. Hand lettering letters from the alphabet
2. Sorting blocks
3. Working puzzles

Language Activities

1. Sharing information
2. Vocabulary games
3. Listening to instructions
4. Deciding placement of letters on the blocks

Industrial Arts Activities

1. Constructing cooperatively
2. Discovering properties of wood
3. Respecting tools and materials
4. Manipulating tools (c-clamp, back saw)

VII. Tools and Equipment:

Miter box
Two carriage clamps (c-clamps)
Back saw

VIII. Materials:

Permanent felt-tipped marker
Furniture wax (or neutral shoe polish)
Rags
Strip of wood $\frac{1}{2}$" x $\frac{1}{2}$" (or 3/4" x 3/4") - the length is determined by the number of cubes desired

VIII. Materials (continued):

Small tin can to hold cubes
Stop block
Abrasive paper (can be taped to the table and the students rub the wood across it)

IX. Safety Considerations:

1. Wear safety glasses while sawing.
2. Work at a relaxed pace and keep fingers away from the saw blade when sawing.
3. When handing a tool to another person, give the handle first.

X. Career Awareness:

The instructor may wish to discuss the following questions relating to careers:

1. How do we get lumber?
2. In what shapes and products do we see lumber?
3. Who cuts and processes lumber?
4. Where can we buy lumber?
5. What types of jobs are involved in getting lumber from the woods to the home?

XI. Procedure:

A. Introduction of the project.

1. Spelling game
   a. Letters placed on wooden cubes.
   b. Cubes tossed by each player.
   c. Player creates words from letters showing.
2. Identification of tools and materials
   a. Miter box - to guide saw when cutting.
   b. Backsaw - named because of its rigid metal back.
   c. C-clamp or carriage clamp - to hold miter box in place on table; another to hold the stop block.
   d. Stop block - a guide to help make all cubes the same size.
   e. Sandpaper - to smooth wood before applying finish.
   f. Wooden strips - to make cubes.

B. Demonstration of cutting the wooden cubes.

1. Begin with square end of the wooden strip (or cut end square in miter box).
2. Strip is held firmly with helping (or non-dominant) hand while:
   a. Against side and bottom of miter box and
   b. Touching stop block.
3. Wear safety glasses when sawing.
4. Dominant hand is used for sawing the strip.

XI. Procedure (continued):

a. Starting cut is made by drawing saw back towards the operator.
b. It is best to use light, even strokes.

C. Sand the sawed ends of each cube.

D. The application of lettering on cubes by using:

1. Ball point pen
2. Permanent marker
3. Paper letters can be pasted on cubes

E. Protective finish.

1. Oil finish will soak into cubes.
2. Wax for final gloss.

F. Rules of the game.

1. Scoring
   a. One point for each word (or one point for each letter used).
   b. One point for each word formed by one roll of cubes or one point for the first word formed.
   c. Decision of whether to count proper names, abbreviations, etc.
   d. Decide who will make judgment decisions.
   e. Decision of how many turns will be played in the game.
   f. Use few rules at first while others can be added as needed.
2. Word cubes mixed in a tin can and rolled by hand.
3. Scoring according to rules established.

XII. Final Suggestions by the Writer:

The amount of cubes to be made depends upon whether each student will have an individual game or share it with a classmate. Arrangement of letters will depend on the vocabulary of the players. There should be at least one cube of only vowels (JEB).

I. Name of Activity: JIGSAW PUZZLES

II. Purpose of Activity: Primary and intermediate children will enjoy making and playing with jigsaw puzzles. Self-confidence is enhanced when they realize that they can make a puzzle as nice as those which can be bought in a store. Art, social studies, language arts and other areas can be incorporated as the teacher feels appropriate.

III. Pictorial Drawing or Photograph:

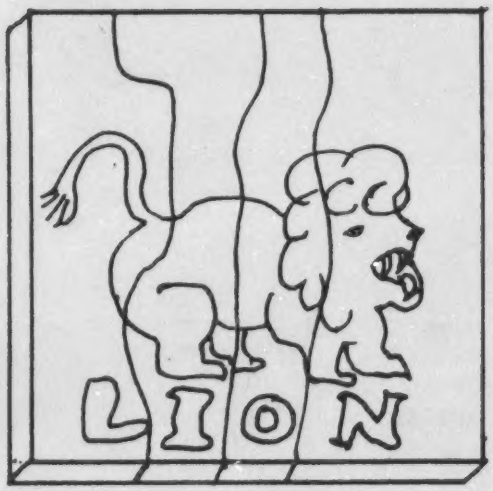


Figure 1.

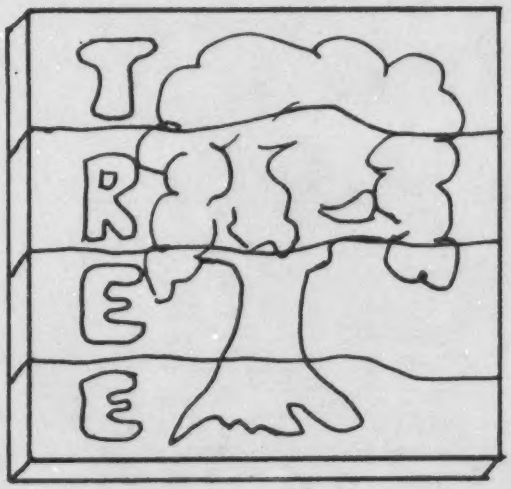


Figure 2.

IV. Working Drawing or Pattern:

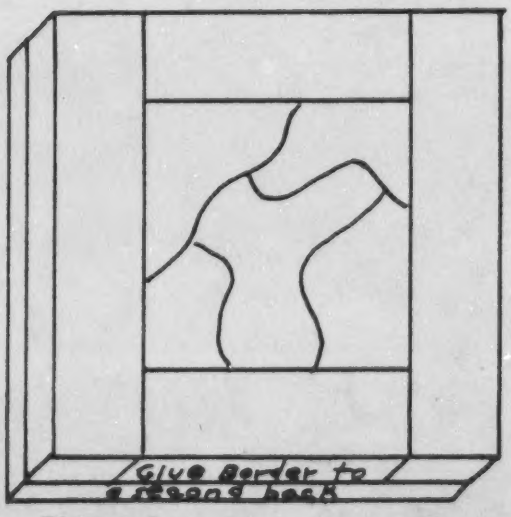


Figure 3.

PRIMARY

INTERMEDIATE

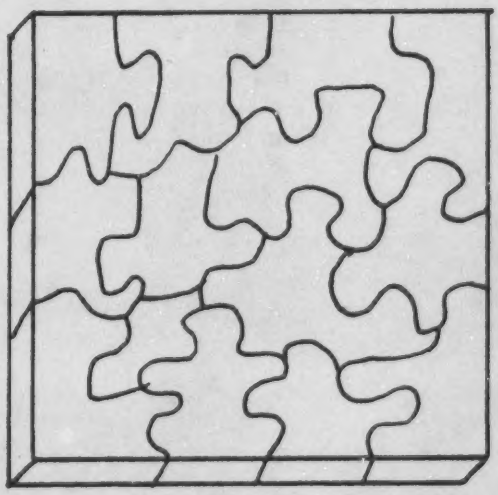


Figure 4.

V. Behavioral Objectives:

Children participating in this activity will:

1. Select a picture for their puzzle (visual discrimination)
2. Glue picture to backing (working neatly)
3. Saw puzzle parts (tool skill, gross motor development, sharing tools)
4. Assemble puzzles (shape and color discrimination, share puzzles)
5. Experience self-esteem and value the work of others
6. Consider the people involved in making commercial puzzles

VI. Application and Acquisition of Skills:

In addition to the skills acquired in making and using the puzzles teachers may include others, such as:

LANGUAGE ARTS - Figures 1 and 2 include simple words which may reinforce left to right and top to bottom orientation for reading readiness. Intermediate children may write short stories or give factual clues to the subject of the puzzle, for example -- a mystery story in which the picture puzzle when assembled provides a clue, or facts such as team, batting average, etc. of the baseball player whose picture is on the puzzle.

SOCIAL STUDIES - Famous people, events, maps, etc. may be pictured on the puzzle.

SCIENCE - Students can take, develop and enlarge (if possible) photographs to be made into puzzles.

ART - Encourage children to draw or paint the pictures for their puzzles. When selecting printed pictures apply art concepts such as color, composition, etc.

VII. Tools and Equipment:

Scissors or paper cutter
Coping saws and extra blades, or small motor jig (scroll) saw
Vee block for each coping saw
C-clamp or vise for each coping saw

VIII. Materials:

Children's drawing, or paintings; magazine or coloring book pictures; or large photographs
Backing for pictures, anything stiff and easy to saw such as: bindersboard, old notebook covers, wall paneling scraps, ceiling tiles, cardboard, etc.
Glue, rubber cement, or paste as appropriate to age of children
Crayons or colored pens
Optional: Transparent contact vinyl or laminating film
Envelopes or plastic bags to store puzzles in

IX. Safety Considerations:

Keep fingers to the side or behind the saw blade, not right in front of it.
Wear safety glasses or goggles when sawing.
Use of the paper cutter should be carefully supervised.

X. Career Awareness:

Some of the people involved in making puzzles might be:

Artists, photographers - to make the pictures
Printers - to print the puzzles
Papermakers - to make the paper
Box makers - to make the cardboard boxes
Truck drivers-to bring materials to the puzzle factory and to take the puzzles to the store
Store clerks - to sell the puzzles

XI. Procedure:

1. Make, or select, the pictures to be used for each puzzle.
2. Obtain heavy cardboard or other material, for the backs of the puzzles.
3. Cut the pictures and the backs to the same size.
4. Paste or glue the pictures to the backs. Let dry.

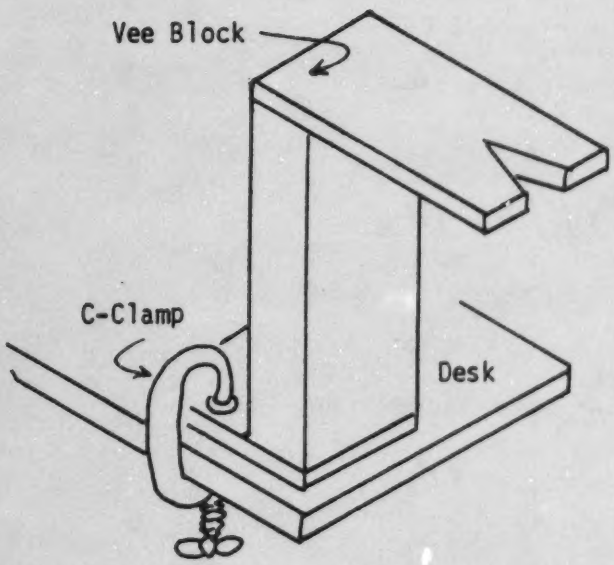
   Optional: Picture surface can be protected with contact vinyl or laminating film, if desired.

5. Color code the back of each puzzle by drawing lines with crayon or color pen. Use a different color (or combination) for each puzzle. If you have ever tried to get children to sort out parts for twenty or more mixed up puzzles you will appreciate the different colored backs.

XI. Procedure (continued):

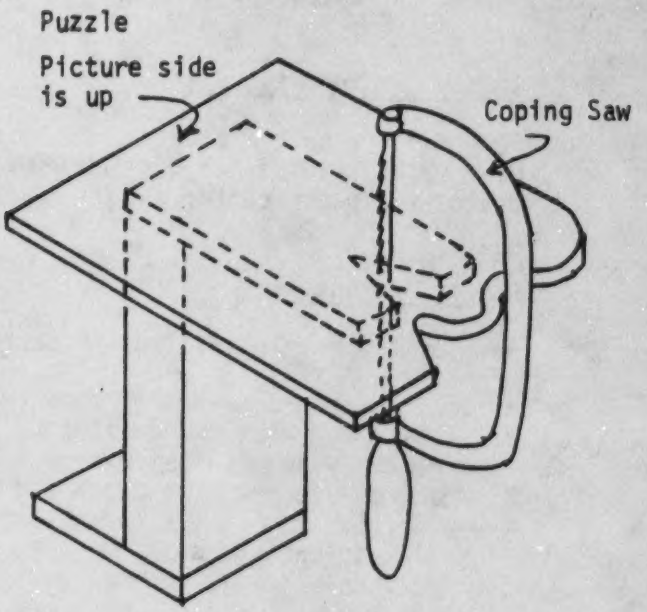
6. Saw out the puzzle parts. (See figures 5 & 6) Do not mark lines to follow. It will be easier to follow an imaginary line. The naturally wavy lines of primary children will be fine. Intermediate children should try to cut interlocking shapes as in commercial puzzles (Figure 4).

   Optional: To make framed puzzles for primary children (Figure 3) have each child cut a long border strip from each edge of the puzzle (wavy cuts are fine), then glue each border strip to a second piece of backing material which is the same size as the original back to which the picture was glued. The loose inside pieces may then be cut and assembled within the frame.



Clamp vee block to desk, or hold in a vise.

Figure 5.



Cut close to bottom of vee. Turn puzzle while sawing for curved cuts. Note: teeth of blade point into picture side of puzzle. Keep blade perpendicular to puzzle surface.

Figure 6.

XII. Final Suggestions by the Writer:

Framed puzzles are much easier for young children to assemble. Cut border strips using paper cutter, but allow children to saw inside shapes. For intermediate children a motor jig saw, if available, will speed up the work. Much time can be saved if the pictures and backs are trimmed to size by the teacher (DJF).

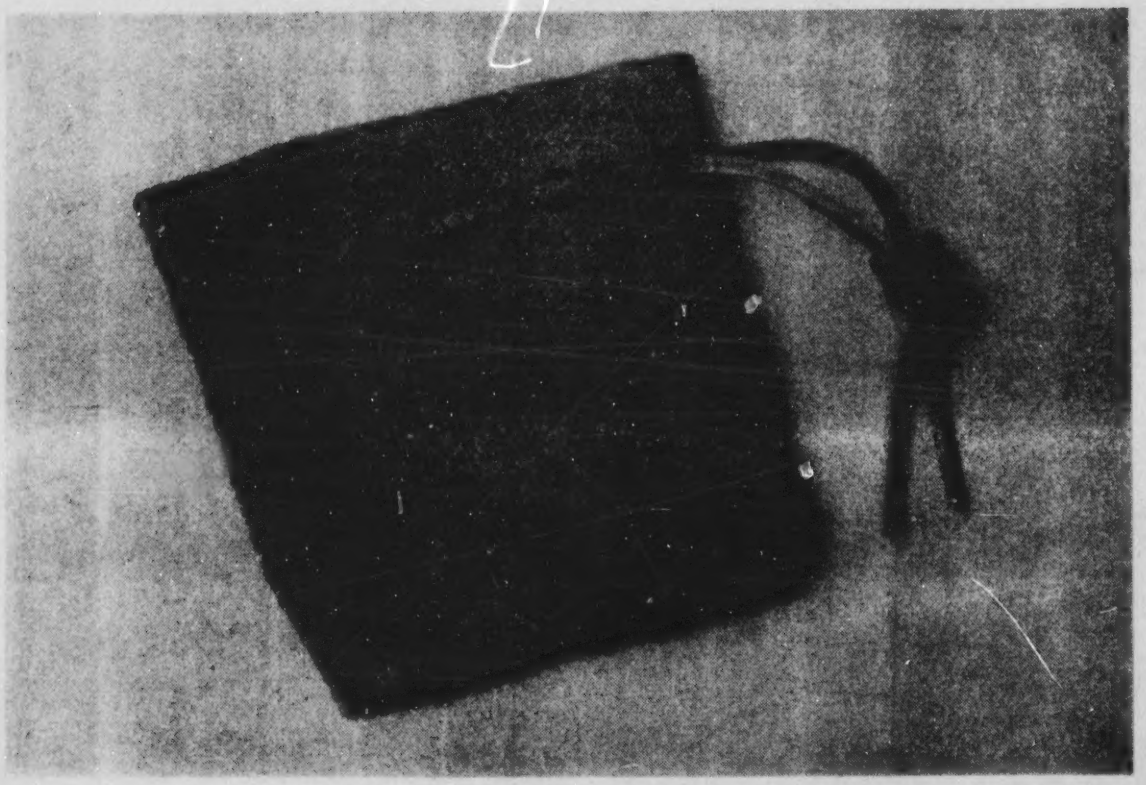
Sample Lesson Plan

I. Name of Activity: Making a Leather Pouch

II. Purpose of Activity:

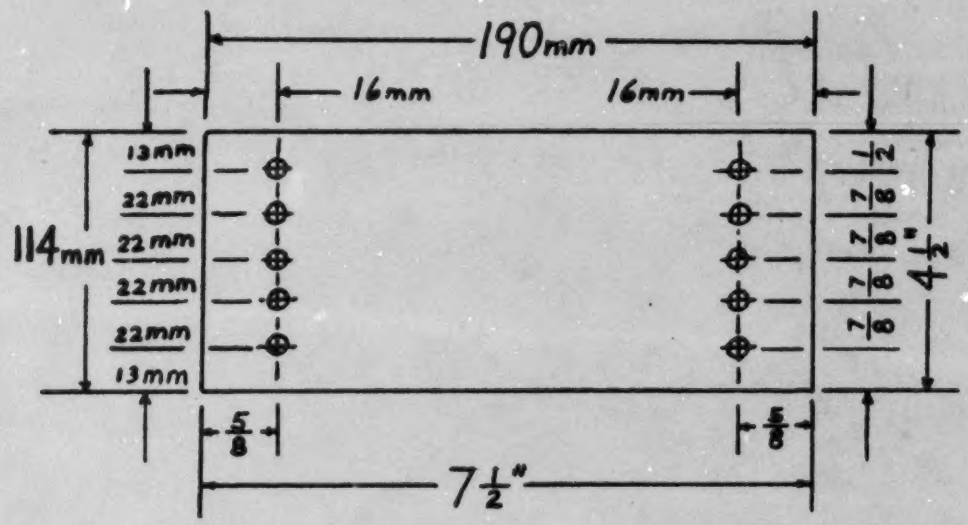
Leather is a material that many early cultures depended upon for their very existence. This primary-level activity introduces young children to leather and how to work with one type. The lesson can stimulate greater interest in studying about any culture that used leather historically or is currently using leather.

III. Pictorial Photograph:

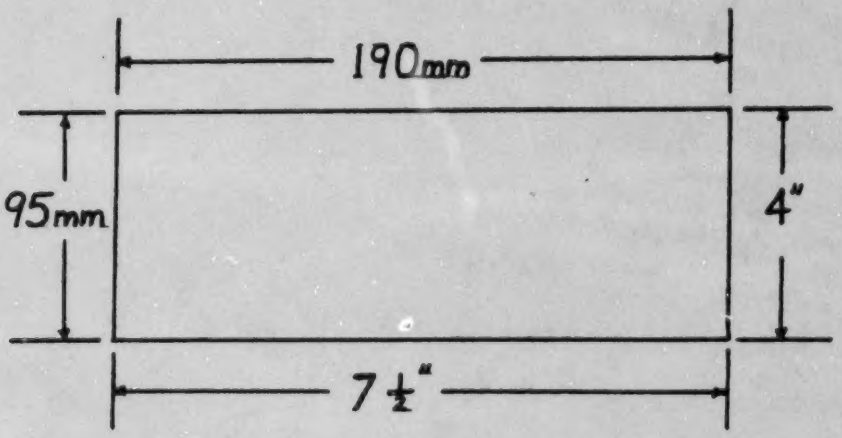


IV. Working Drawings or Patterns: (to be made by the teacher)

POUCH PATTERN
(OAK TAG)



GLUE PATTERN
(OAK TAG)



V. Behavioral Objectives:

These primary-level students will have one 90-minute lesson during which they will:

1. Discuss various cultures that depended upon leather in their daily lives.
2. Discuss animals used for leather and how it was cured.
3. Construct a leather pouch using two to three-ounce split suede cowhide.
4. Share tools during the activity.
5. Take pride in a hand-made product of their own construction.
6. Discuss items in their lives that are made of leather.

VI. Application and Acquisition of Skills:

Gross Motor Training

1. Hitting the hole punch with a mallet
2. Twisting and pulling the punch out of the leather

Fine Motor Training

1. Tracing pouch pattern on leather
2. Cutting leather on traced lines
3. Punching holes in leather
4. Applying rubber cement and folding leather
5. Tying ends of thread after sewing

Language Activities

1. Listening to directions
2. Deciding what process is next in the sequence

Perceptual Activities

1. Identifying leather by its smell, feel and appearance

Industrial Arts Activities

1. Discovering a material - leather
2. Constructing a leather pouch individually
3. Improving gross and fine motor skills through the manipulation of hand tools

VII. Tools and Equipment:

Hollow punches 1/4" dia. (3/8" dia. O.D. Steel Pipe sharpened at one end also works well)
Three-prong thonging chisels
Wooden mallets

VII. Tools And Equipment (continued):

4" x 4" x 4" wooden blocks
Bandage scissors
Pouch templates
Gluing templates
Tapestry needle for each student
Ball point pens

VIII. Materials:

Saddle stitching thread, one roll
Two or three oz. split suede cowhide (for 30 students use 10 sq. ft.)
Leather lacing (1/8" x 1/8" x 20" for each student)
Rubber cement
Newspaper

IX. Safety Considerations:

1. When the students are punching holes and using the thonging chisels, they should be spaced far enough apart on the floor so that they cannot hit each other with a mallet.
2. During the sewing operation, each student should sit at her or his own desk.

X. Career Awareness:

Following the pouch making activity, the teacher could discuss with the students some of these questions.

1. Where does leather come from today?
2. Do you own anything made from leather?
3. What type of jobs do you think were involved in making that leather product?
4. Do you know anyone who works with leather?

XI. Procedure:

A. The process of making this pouch should be outlined on the chalkboard. This procedure should be demonstrated to the class as the following:

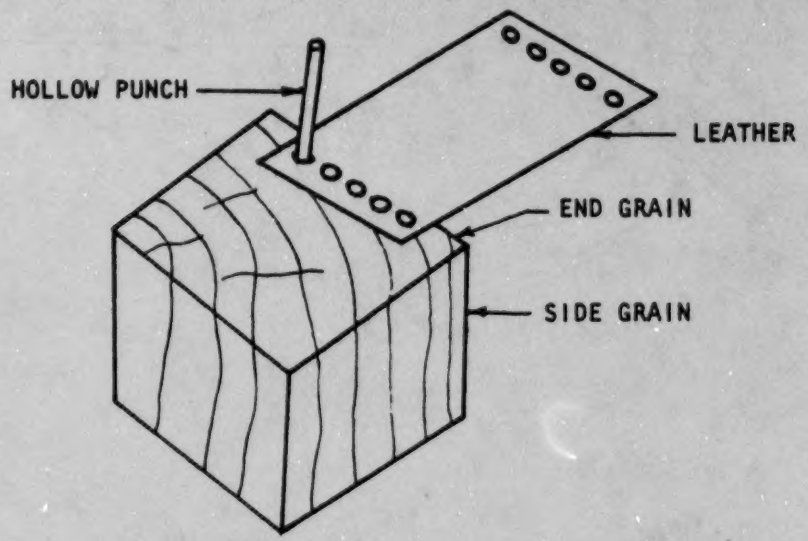
1. Trace pattern on leather.
2. Cut out on the lines.
3. Punch holes.
4. Glue.
5. Fold leather.
6. Draw lines for thonging.
7. Cut slits with thonging chisel.
8. Sew edges.
9. Weave lacing through holes.

B. Trace pattern on leather using a ball point pen. Point out the importance of conserving material. Before the students do any tracing, the teacher will position the pattern on the leather.

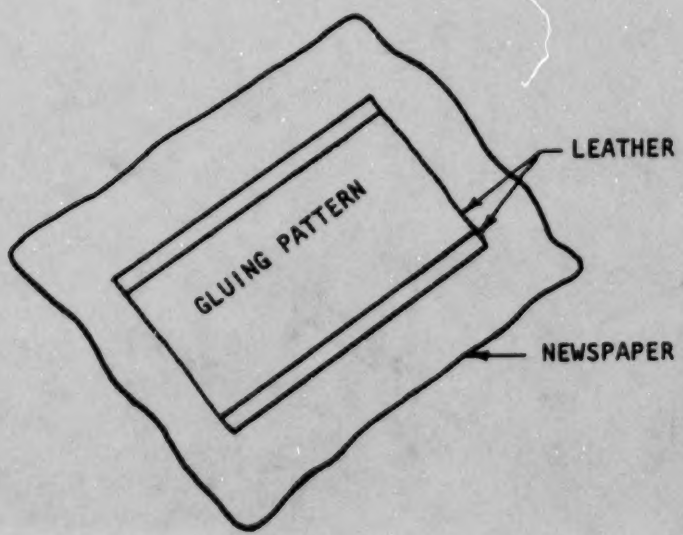
XI. Procedure (continued):

C. Letter your name on your piece of leather. Using the bandage scissors cut on the traced lines.

D. Punch holes using hollow punch, mallet and wooden block with end grain up. Holes cannot be punched properly on side grain of wood. Hit the punch hard enough to penetrate the leather.

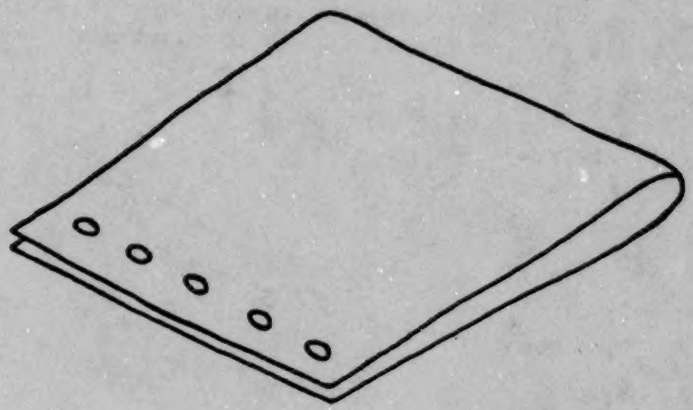


E. Gluing is done by placing the clean side of the leather up - or name side down on newspaper. Place gluing template on top of the leather so that 1/4" space shows on both long edges. Spread a thin coat of rubber cement along each edge and remove gluing patterns.

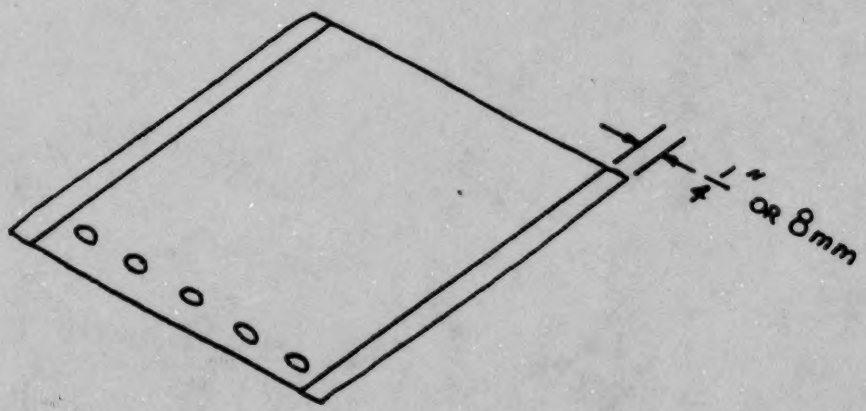


XI. Procedure (continued):

F. When the glue is dry, fold the leather in half by lining up the corners on each end.

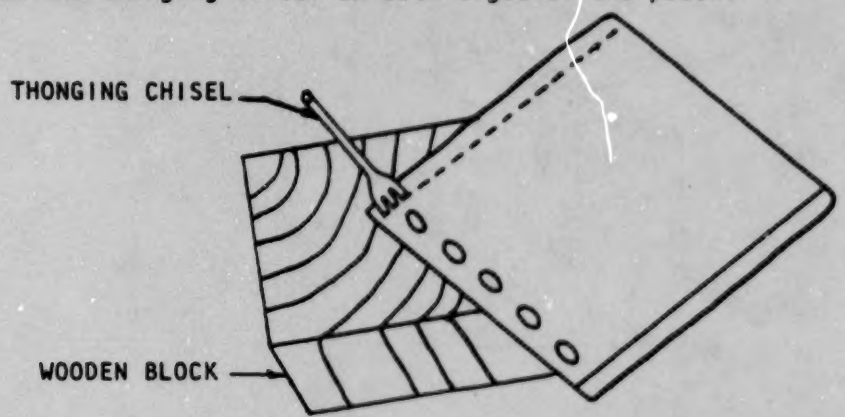


G. Take the pouch to your teacher so that a line can be drawn up each edge with a ball point pen. The line is drawn from the fold to the top of the pouch 1/4" in from each edge.

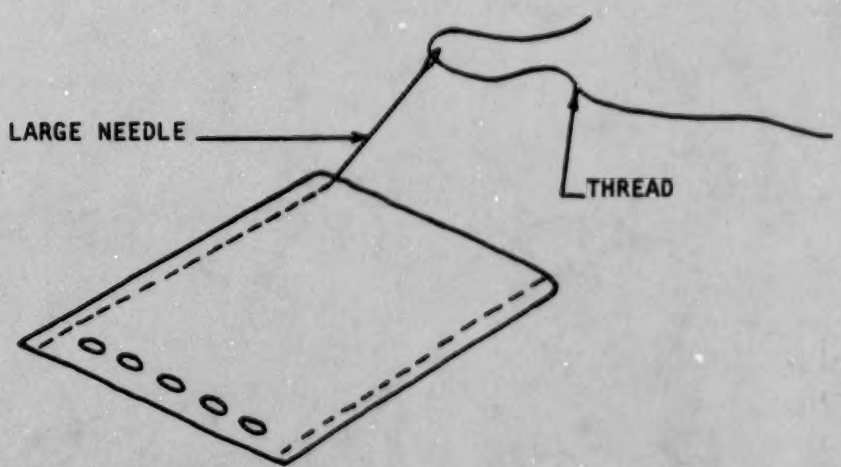


XI. Procedure (continued):

H. The lines will enable you to locate the proper place to cut slits for sewing while using a thonging chisel. Lay the pouch on a wooden block with end grain up, position thonging chisel on the line beginning at the fold and strike it with a mallet until the teeth show through the other side of the leather. Repeat this operation by putting the last tooth of the chisel in the last slit made in the leather. Strike the chisel with a mallet. Make sure that the last slit on the top of the pouch does not cut the edge of the leather. Use the thonging chisel on both edges of the pouch.

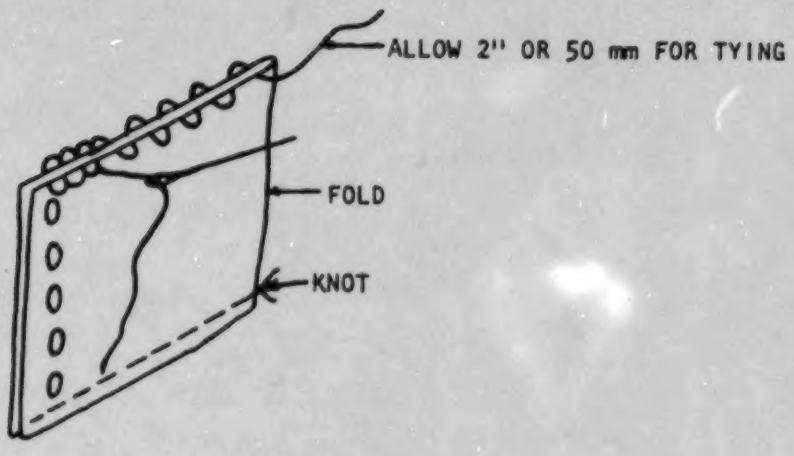


I. When thonging is completed, each student should pick up a needle and a 17" long piece of thread. Thread the needle and allow about 4" of thread on one side of the needle and the remainder on the other side. Do not tie the thread to the needle.

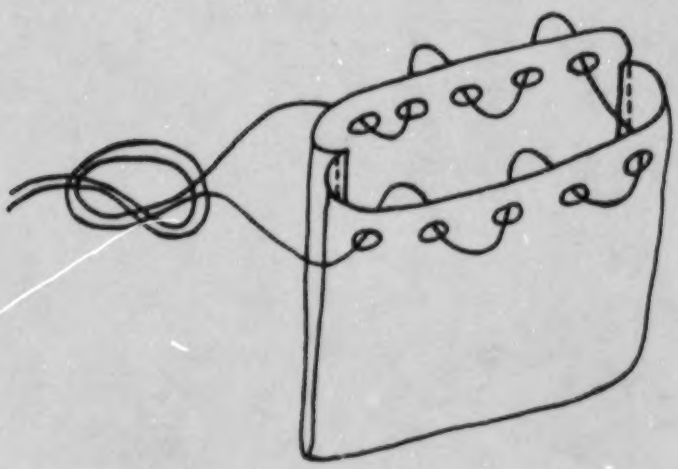


XI. Procedure (continued):

J. Begin sewing at the fold and sew in and out of each slit to the top of the pouch, then sew back to the starting point. If the slits are hard to see, pinch the edge of the pouch toward the middle and the slits will show. Pull each stitch tight as you sew. When sewing is completed, tie the loose ends using a square knot.



K. After sewing, trim off excess thread and turn the pouch inside out. Using a piece of leather lacing, begin weaving lacing through the first hole near the edge of the pouch. Feed lacing in one hole and out the next all around the top of the pouch. Tie the two ends of the lacing together as in this sketch.



XI. Procedure (continued):

L. Following the demonstration, the class should be given some related work to do as the teacher involves the first group of four students in tracing. The hole punches and thonging chisels along with wooden blocks and mallets should be distributed in work areas (on the floor). As the students finish tracing, they move to hole punching, gluing, etc. It is a good practice to enlist the aid of two or three older intermediate students to assist (but not to do for) these younger students. Students will follow each step at their own pace until they have completed the pouch.

XII. Final Suggestions by the Writer:

The bandage scissors are an absolute necessity for the children to be able to cut leather easily and accurately. Along with or instead of student helpers, homeroom parents could be asked to come to the classroom to help in the supervision of the various work stations (DCH).

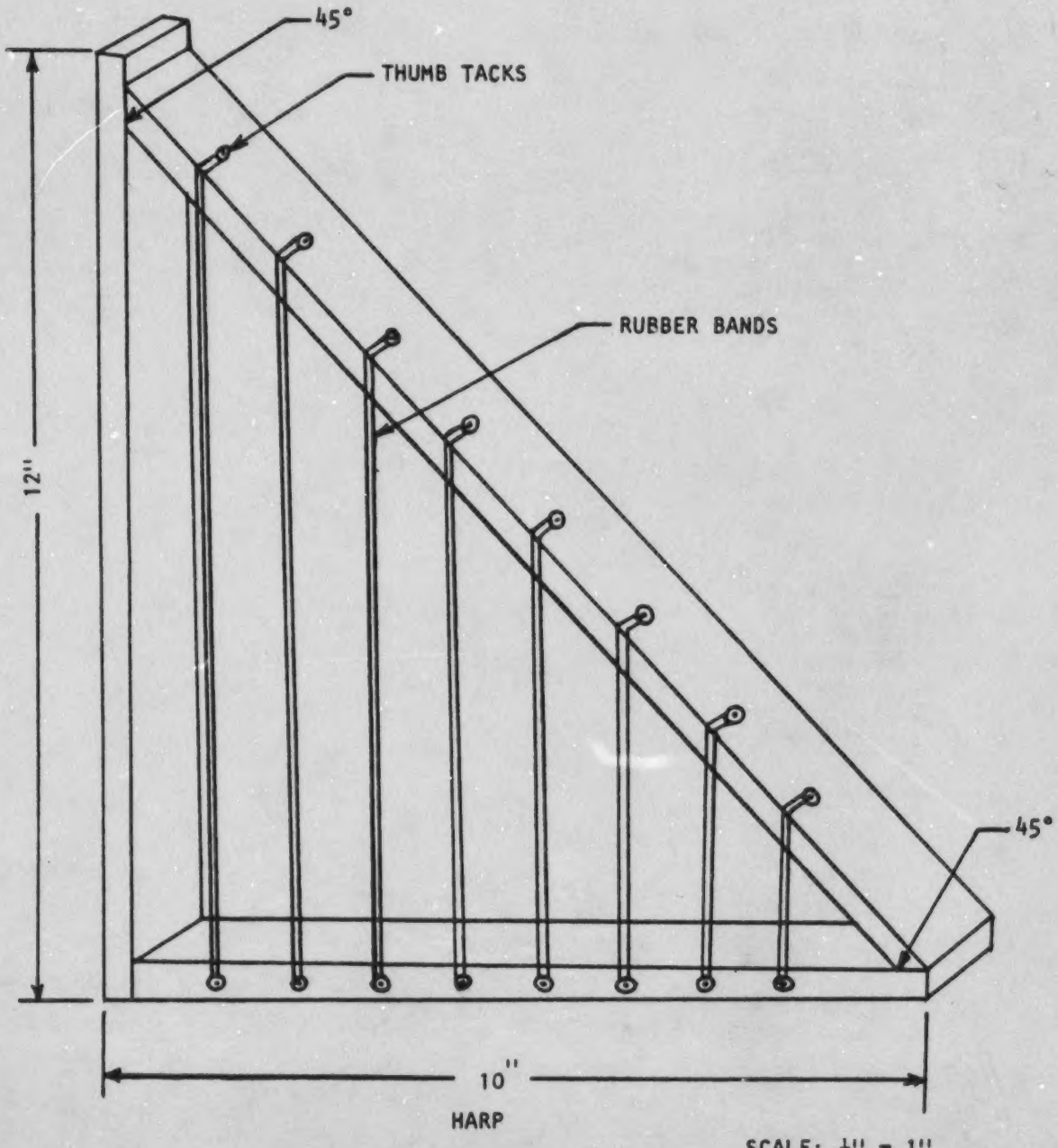
Sample Lesson Plan

I. Name of Activity: Making a Musical Instrument

II. Purpose of Activity:

Introduce primary students to one way that a musical sound can be produced.

III. Pictorial Drawing:



HARP

SCALE: ½" = 1"

IV. Behavioral Objectives:

As the result of this unit, each primary student will:

1. Discuss how musical sounds are produced by "strings".
2. Discuss how the "pitch" is changed by using different length strings.
3. Discuss how "tension" changes "pitch".
4. Use a saw and miter box to cut angles.
5. Assemble, glue and finish one wooden harp.

V. Application and Acquisition of Skills:

Gross Motor Training

1. Hammering
2. Sawing

Perceptual Activities

1. Comparing
2. Associating
3. Auditory perception
4. Classifying
5. Motor perception
6. Tone differentiation

Language Activities

1. Listening
2. Reacting
3. Noting relationships

Fine Arts Activities

1. Creating music
2. Exploring pitch, tone, intensity
3. Experimenting

Industrial Arts Activities

1. Constructing individually or cooperatively
2. Discovering of materials
3. Improving gross and fine motor skills
4. Respecting tools and materials

VI. Tools and Equipment:

Staple gun
Back saw
Miter box
Small claw hammer, 7 oz.
Goggles, one pair for each student

VII. Materials:

Soft wood such as pine, 1/4" or 3/8" thick x 1 1/2" wide
Thumb tacks
Rubber bands, various sizes

VIII. Safety Considerations:

1. The students should be instructed on the safe use of the back saw, staple gun and claw hammer.
2. Be sure to use goggles when sawing, stapling or installing thumb tacks as required by state law.

IX. Career Awareness:

Explain the careers available in music to include the people who make instruments. Ask students to list careers in music. A visit from a musician or craftsman who makes instruments would help create career awareness.

X. Procedure:

1. Show a sample of the "harp" the students will construct.
2. Demonstrate the use of the miter box and how they may use it to cut the parts for the wooden frame of the harp. Have each student cut three pieces of soft wood 1" or 1 1/2" wide. One piece should be 9" long, one piece 12" long and one piece 15" long. Pre-mark each piece for the proper angle as indicated on the drawing.
3. Use any fast drying glue to fasten the three pieces together. Use a 1/2" staple to hold the pieces in place while glue is drying. (The instructor should operate the staple gun for primary students.)
4. Mark the spacing on each side of the triangle to locate thumb tacks 1" apart. Provide students with a template for marking thumb tack spacing.
5. With a small hammer have the students drive the thumb tack half way in at pre-marked locations.
6. Attach rubber bands to the thumb tack by looping over thumb tacks at each end.
7. Have students demonstrate various tones created by different length rubber bands.
8. Show the students how to create a simple tune using the eight tones of their harps.

XI. Final Suggestions by the Writer:

The teacher may want to construct a small fixture to help hold the three pieces of wood for gluing. Students will have to be closely supervised while cutting angles on ends of 10" wood strips. The shape may be altered to utilize available materials or to allow the students to create their own designs (NEL).

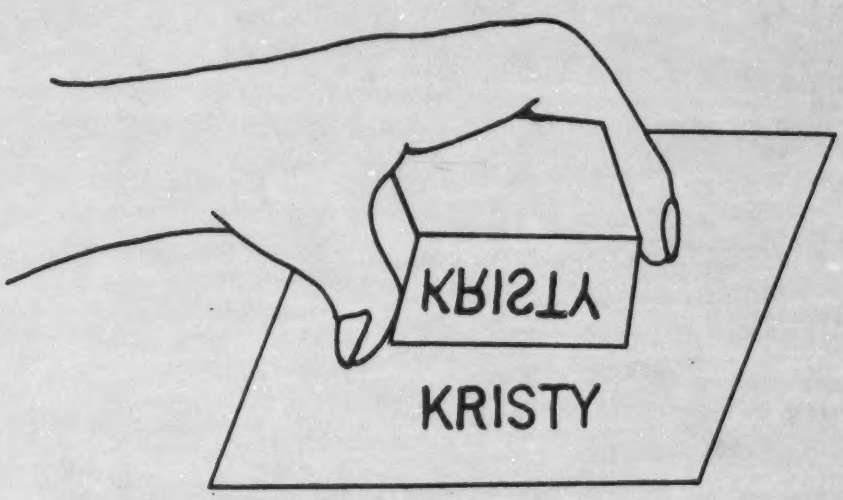
Sample Lesson Plan

I. Name of Activity: Relief Printing or "Thanks to Gutenberg".

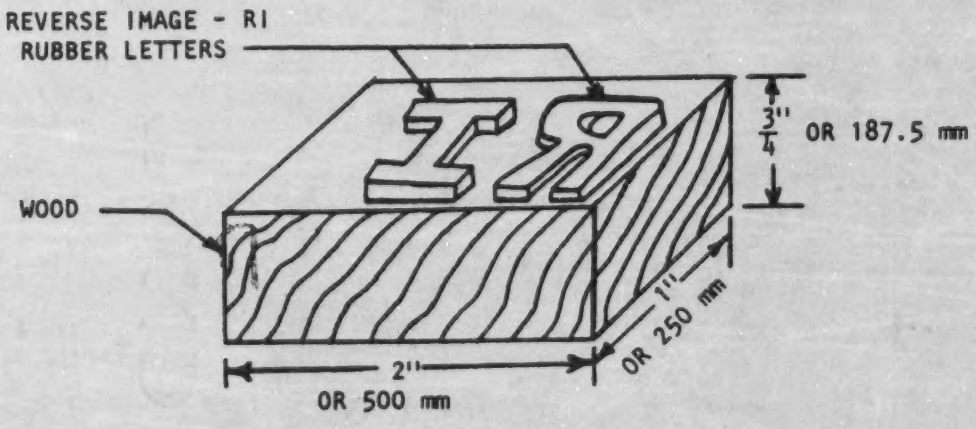
II. Purpose of Activity:

This lesson is designed to interest elementary students in the printed word. Through this activity, the student could also acquire more interest in language arts, the historical implications of Gutenberg's inventions and the actual printing of their spelling words.

III. Pictorial Drawing:



IV. Working Drawing or Pattern:



RUBBER STAMP

V. Behavioral Objectives:

At the completion of the making and using of this rubber stamp, each student will be able to:

1. Relate the rubber stamp to printing.
2. Create words using several rubber stamps.
3. State the effect of foundry type on written communication.
4. Trace, cut and glue materials in an organized and effective manner.
5. Display a willingness to plan and complete a task.
6. Demonstrate a willingness to receive and give assistance when necessary.

VI. Application and Acquisition of Skills:

Fine Motor Training

1. Pasting
2. Punching
3. Writing
4. Tracing
5. Cutting
6. Drawing
7. Printing

Language Activities

1. Discussing
2. Listening
3. Reacting
4. Sharing information
5. Naming objects

Science Activities

1. Experimenting with various inks and paints
2. Observing
3. Mixing
4. Questioning
5. Reporting

Industrial Arts Activities

1. Constructing individually or co-operatively
2. Discovering materials
3. Improving gross and fine motor skills
4. Manipulating tools
5. Respecting tools and materials

VII. Tools and Equipment:

12" rulers
Scissors
Ball point pens
Hollow punch

VIII. Materials:

Writing paper
Rubber cement with brush
Inner tube or gasket rubber
Block of wood (2" x 1" x 3/4")

IX. Safety Considerations:

1. Exercise caution in handling scissors.
2. Ventilation is important when using rubber cement.

X. Career Awareness:

Discuss with the students careers related to printing. The students could role play careers that pertain to graphic design and advertising or decorating. The students could also identify products from the graphic industry in the classroom while discussing the various types of jobs related to their products.

XI. Procedure:

1. Using cardboard letters or stencil letters, trace the letters onto the pieces of rubber. An abstract motif can also be designed.
2. Carefully cut the letters out with a pair of scissors.
3. Transfer the letters or letter (in reverse image) onto the block of wood.
4. Coat the back of the rubber letters with rubber cement and attach them to the block of wood.
5. Using a stamp pad, for the ink source, stamp the letter onto a sheet of paper.

XII. Final Suggestions by the Writer:

Various designs may also be made using the principles described above. These designs could be used as a student's personal logo. An alphabet could be developed and interfaced with spelling activities (DGM).

Sample Lesson Plan

I. Name of Activity: Indian Rhythms

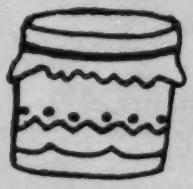
II. Purpose of Activity:

History, music, physical education and industrial arts skills can be incorporated to help primary-level children express the Indian way of life.

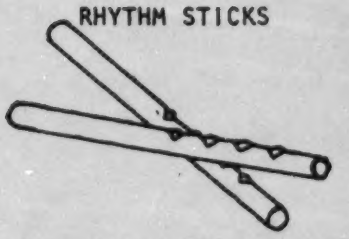
III. Pictorial Drawings:

BONE RATTLE

PAPOOSE TOMTOM



RHYTHM STICKS



IV. Behavioral Objectives:

During this lesson on Indian rhythms, each student will:

1. Manufacture at least one of three different rhythm instruments.
2. Explore the sounds made with the instruments.
3. Create a dance and/or a song with musical accompaniment that expresses the celebration of an American Indian event.

V. Application and Acquisition of Skills:

Gross Motor Training

1. Dancing
2. Hitting
3. Hopping
4. Sawing
5. Shaking
6. Skipping
7. Rhythmic movement

V. Application and Acquisition of Skills (continued):

Fine Motor Training

1. Bending wire
2. Cutting
3. Drawing
4. Painting
5. Tying
6. Writing

Social Studies Education

1. Developing positive attitudes toward people and things
2. Learning about families and family order
3. Appreciating workers

Language Activities

1. Reading and discussing the life styles of the different tribes of American Indians
2. Relating and reporting how the Indian lifestyle influenced American art - past and present

Industrial Arts Activities

1. Constructing individually or cooperatively
2. Discovering materials
3. Manipulating tools and materials
4. Respecting tools and materials

VI. Tools and Equipment:

Scissors
Sandpaper, 120 grit
Slip-jaw pliers, 6" long
File, flat or half-round for wood, 10 or 12" long, rough cut
Side-cutting pliers for cutting wire, 6" long
Paint brushes, assorted sizes
Small panel or coping saw

VII. Materials:

Wire hangers
Dried animal bones
Coffee cans
Wrapping paper
Heavy string or strong rubber bands
Paint, latex base
Colored paper
Dowel rods, ½ inch in diameter (other sizes are optional)
Masking or plastic electrician's tape, 3/4" wide

VIII. Safety Considerations:

1. Care in bending wire.
2. Care in not touching wire immediately after it is bent (hot to the touch!).
3. Adult or older children should supervise the manufacturing process.
4. Sawing may be done prior to class.
5. Goggles must be worn when filing or sawing wood or metal.

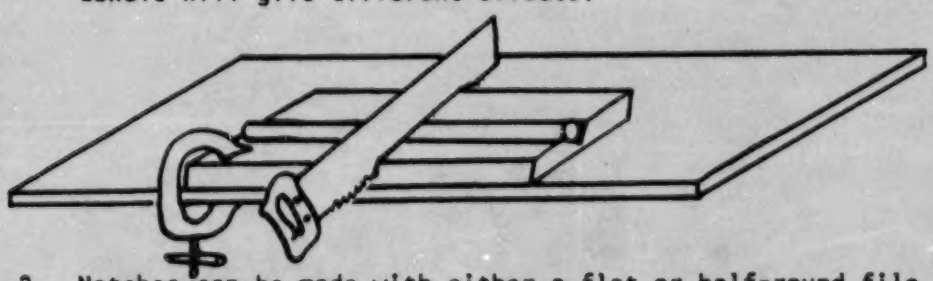
IX. Career Awareness:

There are many opportunities in today's society dealing with the fine arts. This would include the designing of manufactured items, advertisement, entertainment, the constructing of buildings and personal clothing to mention only a few. Several excellent sources of help and assistance would include the art teacher or persons who produce craft items at the local level.

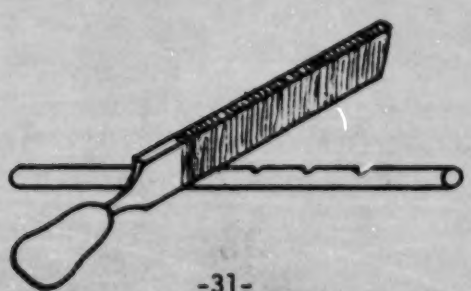
X. Procedure:

1. Introduction.
   A. What instruments might have been used by the Indians?
   B. How did they get the musical instruments?
   C. Why did the Indians need rhythm instruments?

2. Manufacture.
   A. Each student may select to make either a bone rattle, papoose tomtom or rhythm sticks.
   B. Fifth or sixth-grade students may be used as aides, thus giving them the opportunity to lead younger children in an activity.
   C. Rhythm sticks.
      1. Cut dowel rods 12 inches in length. The average size for rhythm sticks should be ½ inch in diameter. Different size dowels will give different effects.



      2. Notches can be made with either a flat or half-round file.



X. Procedure (continued):

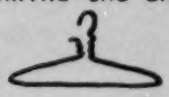
3. Sand rough edges.
4. Paint if desired or use wax or neutral shoe polish.
5. Sticks can be struck together, rubbed against the notches along the middle of the stick or even used against a different type of object. Rhythm sticks generally supply the after beat while the drums supply the accented beat.

D. Bone rattle.

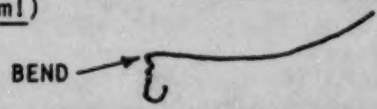
1. These are made from either buffalo or deer claws and hoofs. One can also use the round bones from pieces of ham or lamb chops. Each child will need five to six bones.
2. Soak the bones in hot water and detergent to get rid of the grease.

3. Dry them in the sun.

4. Unwind the ends of the hanger so you have a long wire.



Break off the wire to a ten or twelve inch length by bending the wire back and forth at the same spot until it snaps. (The ends will be hot so do not touch them!)



Attach the bones to a ring made from a wire hanger.

5. Wind the ends of the wire around each other to form a handle.

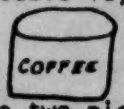
Wrap any sharp points with masking or electrician's tape.

6. When the students are using the bone rattle, be sure to have them shake it away from their face (not toward!)

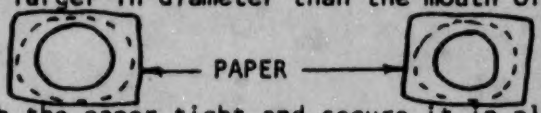
X. Procedure (continued):

E. Papoose tomtom.

1. Replace the plastic cover of a round empty coffee can with a double layer of wrapping paper glued together.



2. Cut these two pieces of wrapping paper in a circle two inches larger in diameter than the mouth of the can.



3. Stretch the paper tight and secure it in place with string or a strong rubber band around the circumference of the can.

4. Decorate the drumhead with paint.
5. Paint the frame or paste over it with colored paper. (This is accomplished easier before the drumhead is placed over the end of the can.)

3. Creation of a song and/or dance.
   A. Divide the class into groups of six.
   B. Explain several basic ideas such as harvest, celebration, rain dance, sun dance, etc.*
   C. Group selects an event.
   D. Group experiments with various rhythms.
   E. Group experiments with various movements.
   F. Group makes a sequence of movements, words and sounds to form a song or dance.

* Additional sources.

Belting, Natalia M. The Long Tailed Bear and Other Indian Legends. Bobbs, 1961.

Clemens, James R. Invitation to Rhythm. Dubuque, Iowa: Wm. C. Brown Company Publishers, 1962.

Grinnell, George Bird. Blackfoot Lodge Tales. University of Nebraska Press, 1962.

Mandell, Muriel and Robert E. Wood. Make Your Own Musical Instruments. New York: Sterling Publishing Co., Inc., 1964.

Vernazza, Marcelle. Making and Playing Classroom Instruments. San Francisco, California: Fearon Publishers, Inc., 1959.

X. Procedure (continued):

4. Presentation to the class.
   A. Use a large open space in the room or outside.

XI. Final Suggestions by the Writer:

There can be the sharing of Indian tales using children's original rhythms as accompaniment. Also, the creation of a play concerning aspects of the Indian culture, listening to authentic Indian rhythms and comparing various rhythms will add to the unit (MN).

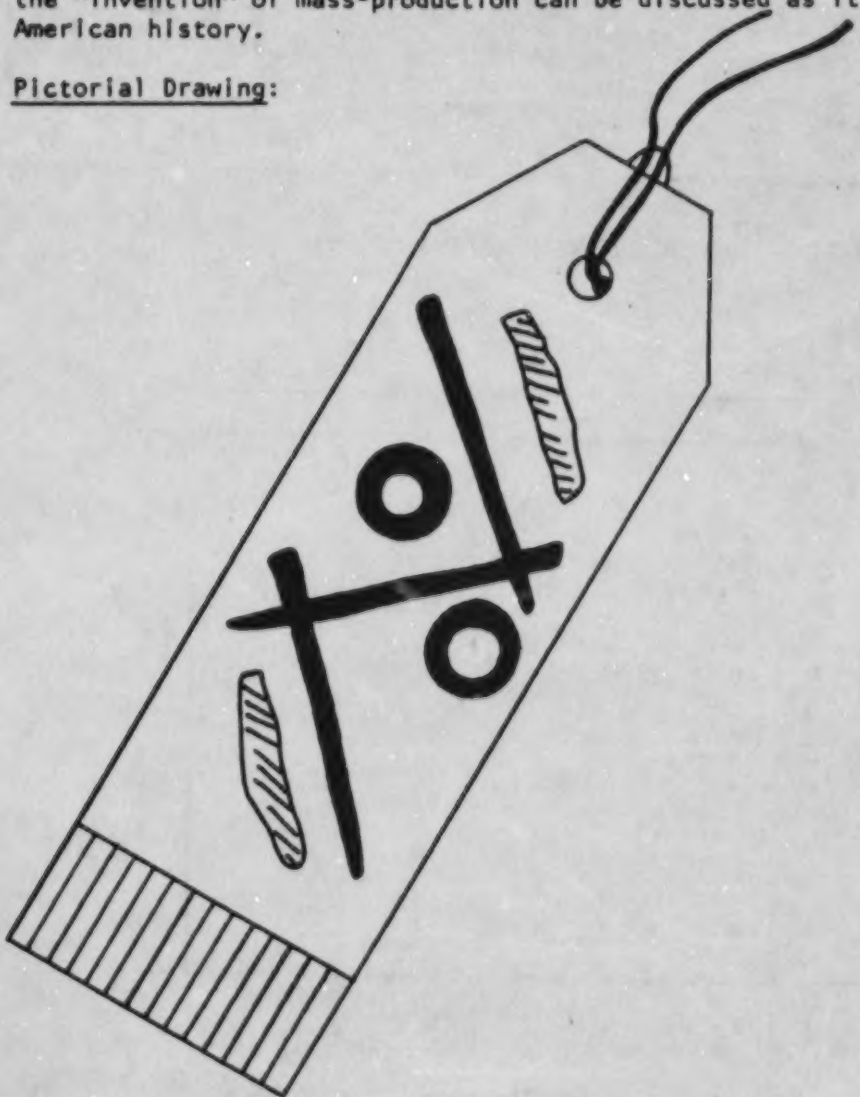
Sample Lesson Plan

I. Name of Activity: The Mass Production of a Book Mark
or The American Genius

II. Purpose of Activity:

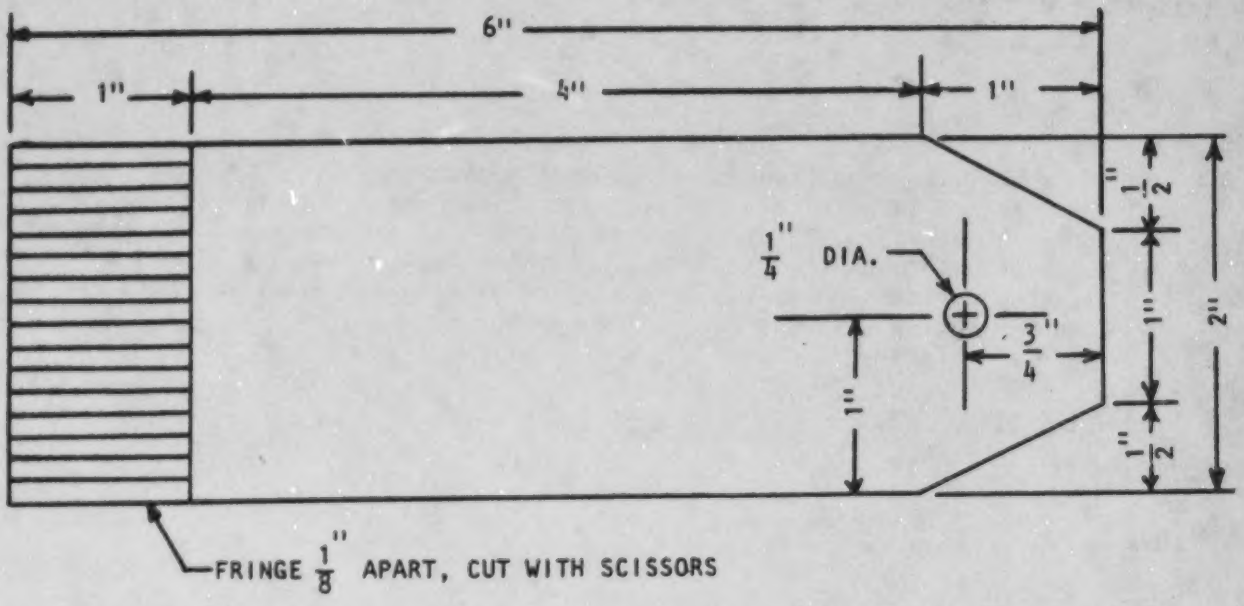
This activity is designed to familiarize elementary students with the basic principles of mass-production, such as: work simplification, division of labor, interchangeability of parts and automatic conveyance of work. Through this activity, the student could acquire a more complete understanding of business and industry in our society. Moreover, the "invention" of mass-production can be discussed as it relates to American history.

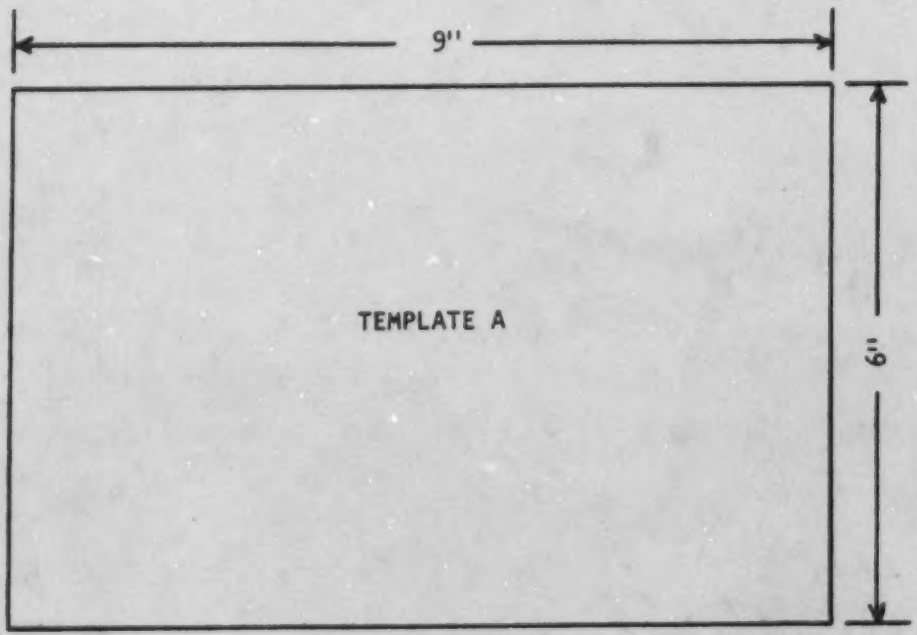
III. Pictorial Drawing:



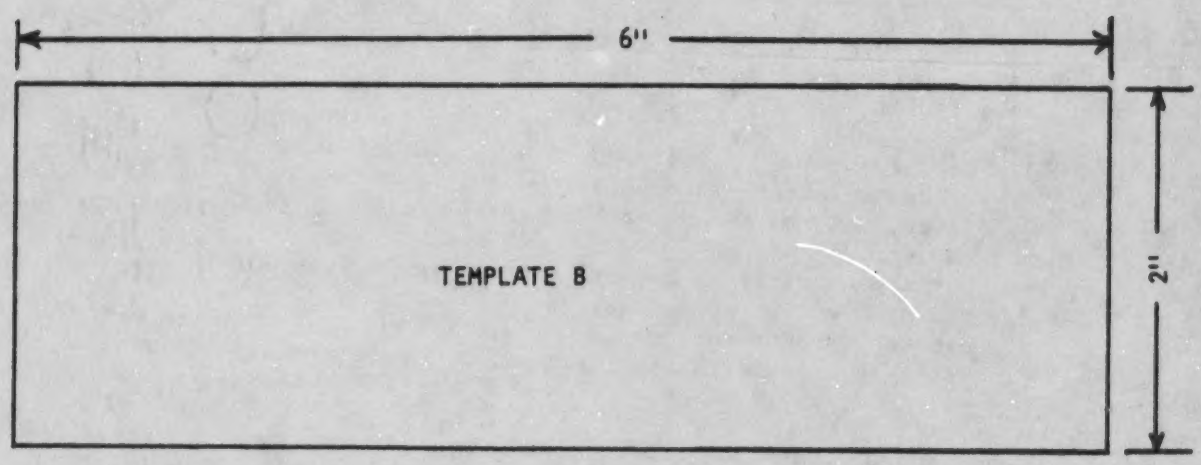
BOOK MARK

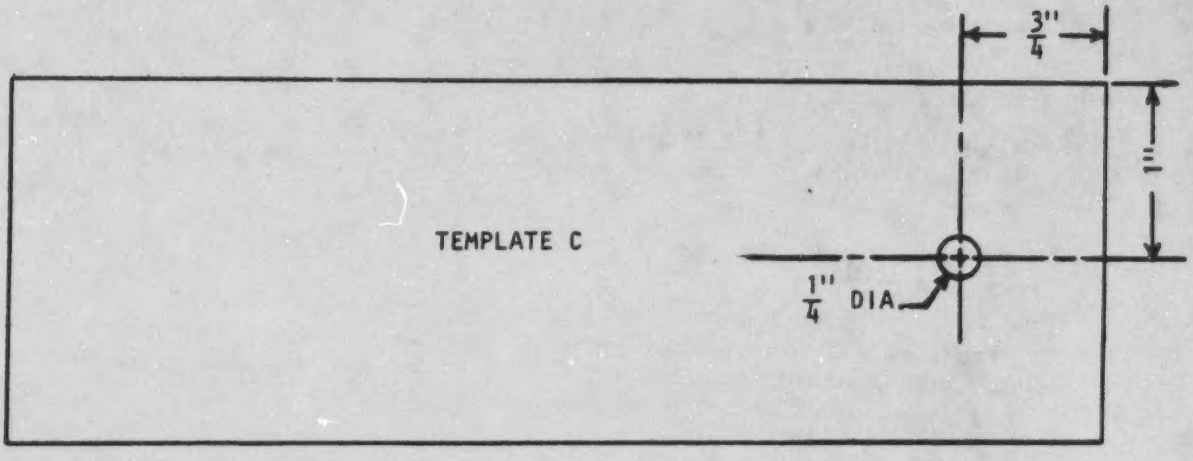
IV. Working Drawing and Templates:

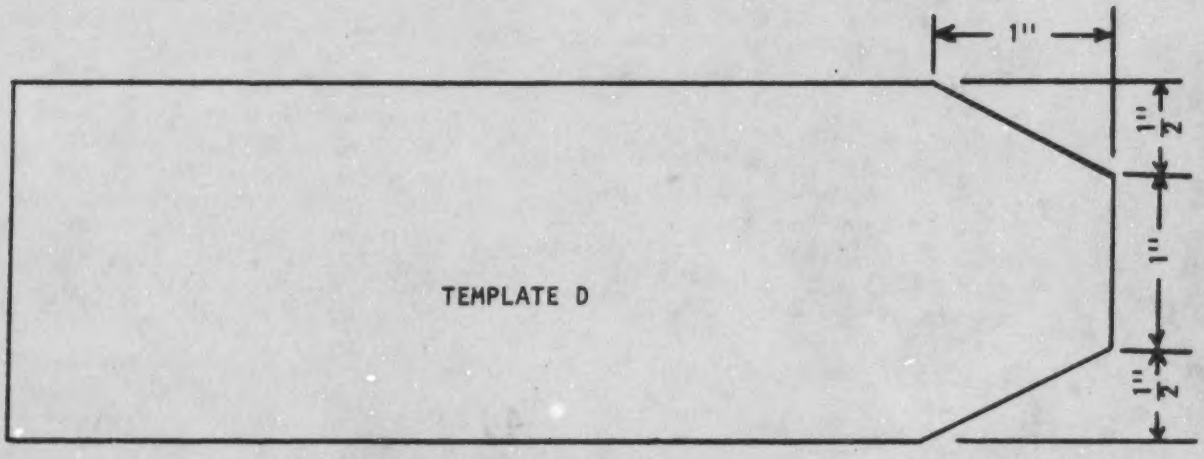




IV. Working Drawing and Templates (continued):







V. Behavioral Objectives:

At the completion of mass-producing the book marker and participating in preliminary and supplemental learning activities, each student will be able to:

1. Define the four principles of mass-production.
2. Describe several manufacturing jobs.
3. Trace, cut, punch and mark materials in an organized and effective manner.
4. Perform repetitious as well as management type work.
5. Use math skills when required.
6. Discuss careers related to manufacturing.
7. Write about careers and elements of American history.
8. Relate industry and mass-production to other social events.

Depending on one's particular use of this lesson, numerous other behavioral objectives could be included and relevant to math, language arts, social studies and/or career awareness.

VI. Application and Acquisition of Skills:

Language Activities

Reading, writing and discussion skills may be developed through a business production report, job descriptions, research and other reporting activities.

Mathematical Activities

Counting and basic computations can be encouraged through this activity. Simple stocks and material inventories can be maintained. More advanced activities would include calculating average production rate, product rejection rates and cost-per-item.

Social Studies Education

Some research into America's history will provide considerable information relevent to mass-production's impact on society. Students can trace the advent of the American system of mass-production, particularly interchangeable-parts production (Sam Colt - Six Shooters) and the mechanized assembly line (Henry Ford's - Model "T"). "In 1853, 'mass production' was a reality for only a few select manufacturers of such items as guns, locks and clocks. By 1893, the 'Ingenious Yankee' had figured out how to mass produce and mass market almost everything." (The Smithsonian Book of Invention, p. 28.) Mass production then was well established in the twilight of the nineteenth century. The amount of influence this method of production has had on our society is a viable discussion topic.

VI. Application and Acquisition of Skills (continued):

Industrial Arts Activities

The teacher can provide the students with information relevent to industrial processes and careers while enhancing the students' appreciation of technology, industry and the world of work. Students participating on the assembly line will cooperate with each other in a simulated work situation. Moreover, this activity will provide further understanding of the interdependence of people, tools and work.

VII. Tools and Equipment:

Scissors, 12 pair
Templates, A, B, C and D - (See detail drawing in section IV), three of each
Hole punches for paper, three in count
12" Rulers, three in count

VIII. Materials:

White drawing paper, construction paper or oak tag, 15 pieces
Colored pencils, three in count
Roll of 1/4" wide ribbon or thin yarn, (12" per book mark)
Potato or other objects for printing, three pieces
Stamp pads, sponges or paper towels, three of each
Assorted colors of tempera paint
Newspaper, to cover desks

IX. Safety Considerations:

1. This activity is similar to other usual classroom activities that involve tools, materials and processes of which most children are already familar.
2. The teacher should caution the students about the safe handling and use of scissors.

X. Career Awareness:

Mass production work on an assembly line can help children recognize a variety of manufacturing-type jobs. Supervisor, quality control and assembly jobs can all be part of the lesson. Students could possibly switch jobs during production. This could help stimulate a discussion about likes and dislikes in working situations. The students could become actively involved in pursuing information relevant to jobs associated with manufacturing. For example, they could look in the Dictionary of Occupational Titles for a description of various types of work in this and other areas of employment. Retired employees could be invited to the school to answer questions. In a selective manner, parts of Studs Terkel's book Working could be read to the students. In summary,

X. Career Awareness (continued):

a mass-production activity lends itself to numerous activities involving career/occupational awareness. Occupational choices begin in early childhood when children first become aware that a career is important to their future life style. Diversity of occupational roles is very important in career awareness activities. Also, the issue of sex equity throughout the role modeling years of the elementary school can be addressed through industrial arts activities that promote unbiased role models in the world of work.

XI. Procedure:

The teacher will explain to the children how the classroom will be organized for the production of the bookmark. Each child will be assigned a work station, then taught how to perform the task for which they are responsible.

1. Work station #1

   Divide 9" x 12" paper in half using template "A". This is followed by dividing each half into 4 - 2" strips using template "B".

2. Work station #2

   Using scissors, cut on lines to produce strips 2" x 6".

3. Work station #3

   On one end of each strip, using a ruler and colored pencil, measure in from the end, one inch on each long edge and make a mark. Join marks with a line using pencil and ruler (a sample should be at this work station).

4. Work station #4

   Using scissors, fringe the end of the book mark to the marked line (a sample should be at this work station).

5. Work station #5

   Place template "C" on bookmark so that the hole is at the end opposite fringe. Trace through hole in template, remove it and punch hole in the bookmark using a paper punch.

6. Work station #6

   Place template "D" on end of bookmark with hole and trace corner cuts. Cut corners off with scissors.

XI. Procedure (continued):

7. Work station #7

Measure ribbon or yarn 12" long with a ruler, cut with scissors, thread two ends through hole in bookmark, place ends of ribbon through loop and tighten.

8. Work station #8

For decoration, print image on bookmark using stamp pad or tempra paint and found object or potato.

9. Work station #9

All bookmarks will be passed to this station for quality control check for cleanliness and accuracy. Rejects will be discarded after ribbon or yarn is removed. Final count of good bookmarks and rejects will be made to determine efficiency of the production line.

Tools and materials required at each work station.

Work station:

#1 - 9" x 12" paper (five sheets), template A and B and a pencil

#2 - Scissors, one pair

#3 - Ruler and colored pencil

#4 - Scissors, one pair

#5 - Template C, pencil and paper punch

#6 - Template D, pencil and scissors

#7 - Ribbon or yarn, ruler and scissors

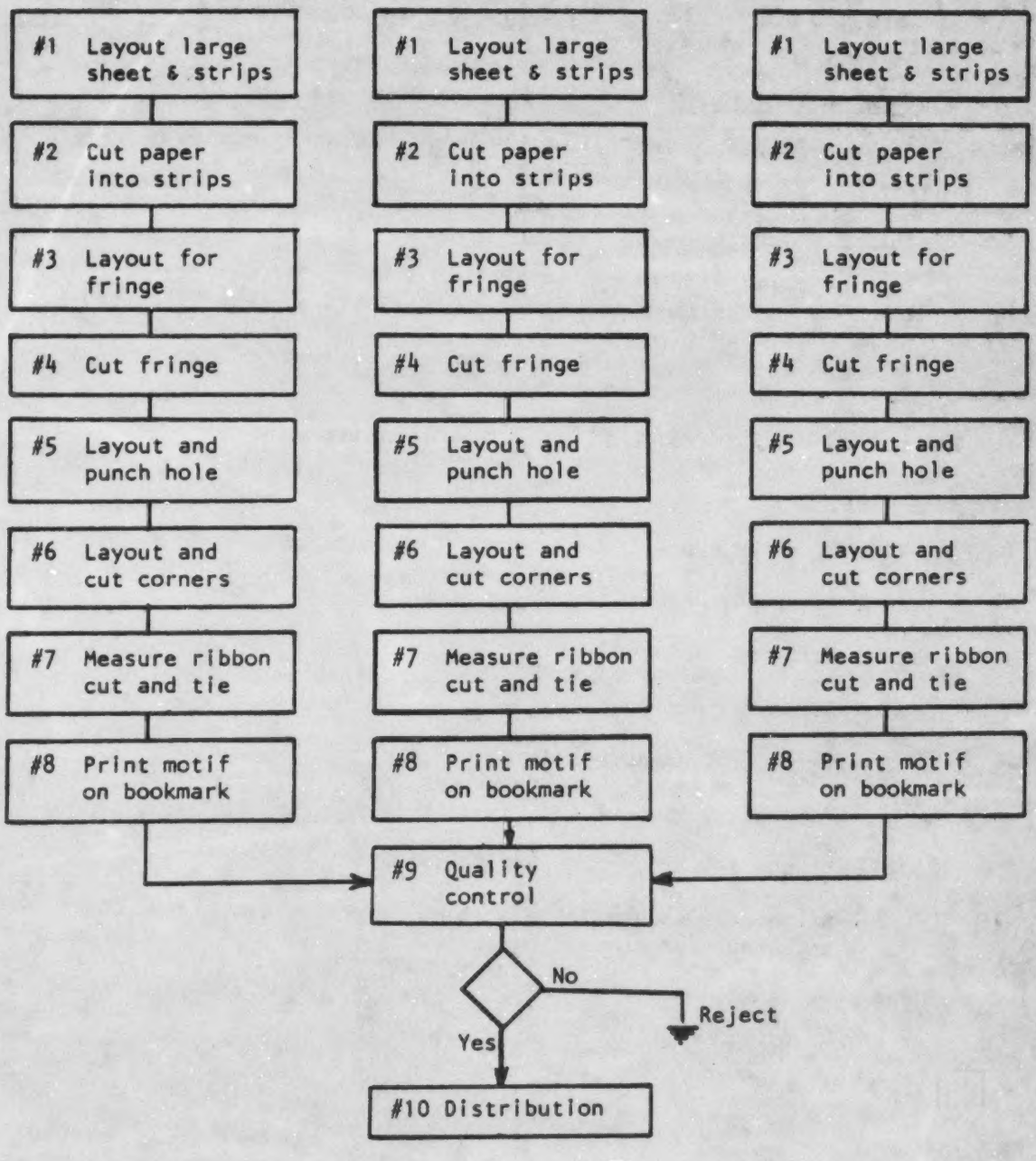
#8 - Stamp pad, sponge or paper towel, vegetable or found object and newspaper

#9 - Newspaper

XI. Procedure (continued):

Production Plan

Each block represents one child at a work station. The number of work stations can be varied to accommodate class size.



XII. Final Suggestions by the Writer:

To make the production line flow smoothly from the beginning, the teacher should prepare a few bookmarks and place them at each work station so everyone can start working at the same time. When the children from work station #1 are finished, they should go to work station #8 to help with the decorating. As other children finish their tasks, they should become the clean-up committee and collect tools and materials (DCH and DGM).

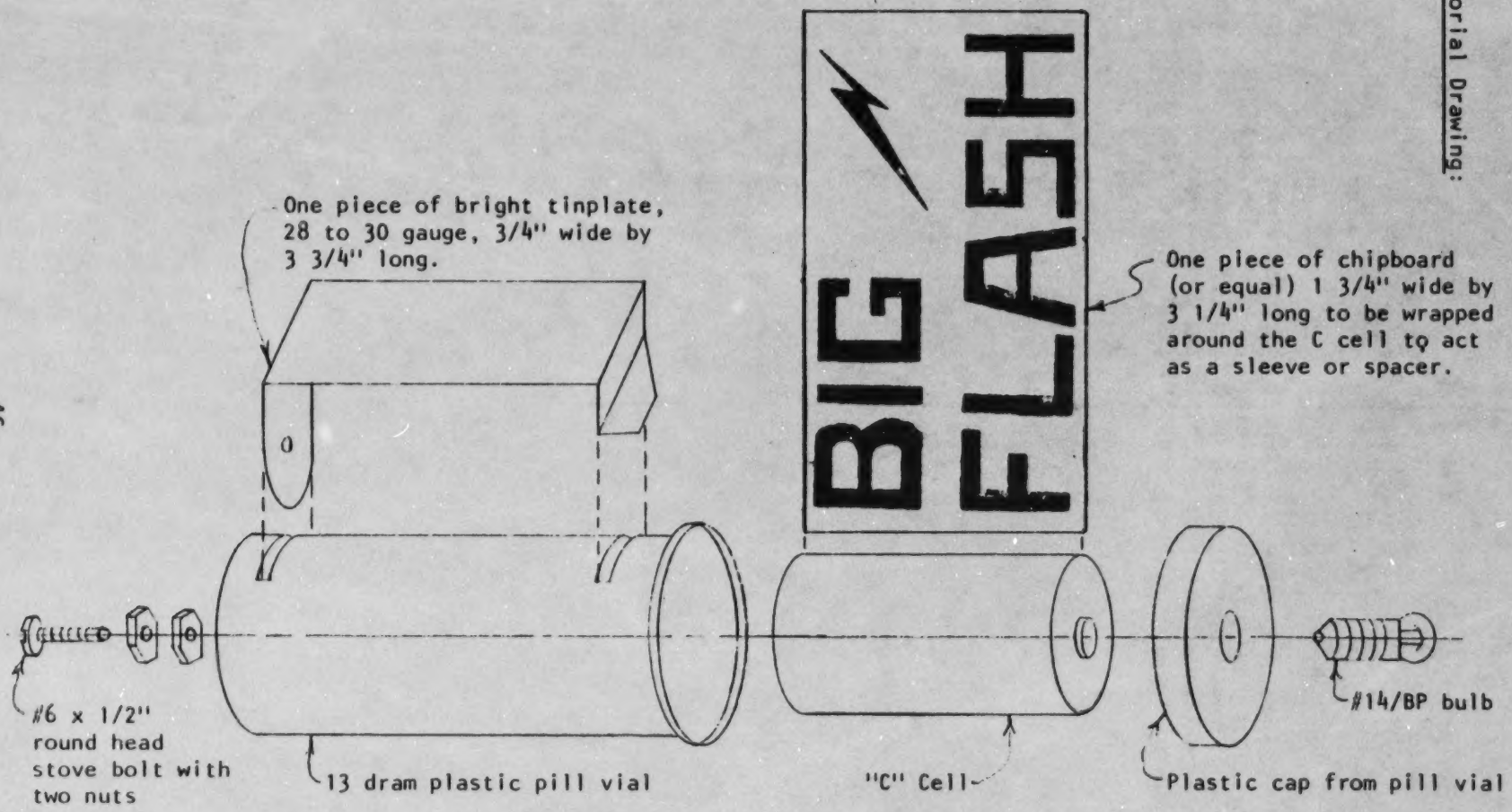
Sample Lesson Plan

I. Name of Activity: Pocket Flashlight

II. Purpose of Activity

The basic scientific concepts of current electricity can be reinforced by the production of this small flashlight. It is also possible to have intermediate-level students achieve skills and understandings in screen printing technology, industrial materials and an awareness of many of the associated careers within these industrial areas of our society.

III. Pictorial Drawing:


One piece of bright tinplate, 28 to 30 gauge, 3/4" wide by 3 3/4" long.
BIG FLASH
One piece of chipboard (or equal) 1 3/4" wide by 3 1/4" long to be wrapped around the C cell to act as a sleeve or spacer.
#6 x 1/2" round head stove bolt with two nuts
13 dram plastic pill vial
"C" Cell
Plastic cap from pill vial
#14/BP bulb

POCKET FLASHLIGHT

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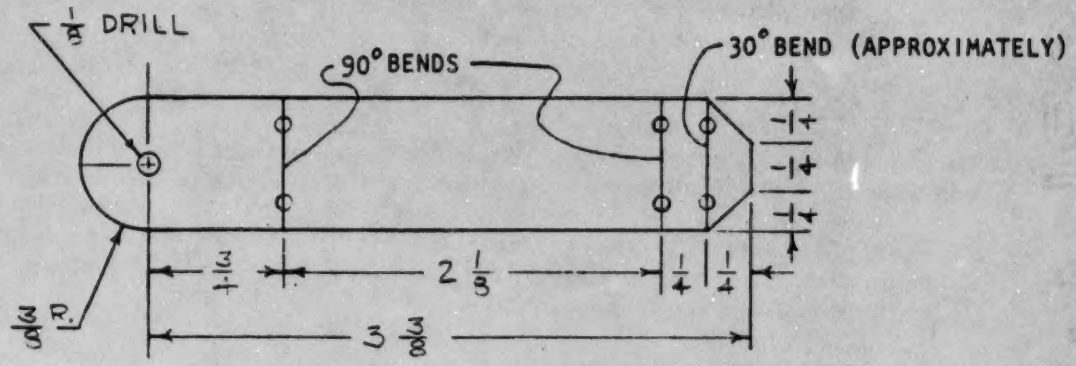
IV. Working Drawing or Pattern:



Material: 28 to 30 gauge bright tinplate.

PATTERN FOR METAL SWITCH

V. Behavioral Objectives:

During this lesson, these intermediate-level students will:

1. Discuss the concepts of current electricity and its ability to produce light and heat.
2. Produce one pocket flashlight for each member of the class using the listed tools and materials.
3. Act as a class or unit by displaying a willingness to discuss, observe and imitate as needed.
4. Assist with all organizational procedures such as helping each other in groups of two, distributing and collecting tools and materials, and clean-up activities.

VI. Application and Acquisition of Skills:

Gross Motor Training

1. Sawing a #6 stove bolt to the proper length using a hacksaw.
2. Sawing two kerfs in the plastic pill vial with a backsaw.
3. Turning the wheel on a hand drill when drilling various size holes in tinplate and plastics.
4. Pushing and/or pulling the squeegee across the screen to produce an image in graphics.

Fine Motor Training

1. Filing the edges of the tinplate after cutting.
2. Filing the end of the #6 stove bolt after sawing.
3. Cutting an image in the film with an Exacto knife prior to screen printing.

Fine Motor Training (continued)

4. Drawing an image for screen printing.
5. Cutting tinplate to length and shape using tinsnips.
6. Bending tinplate to the correct shape using jig and pliers.

Science Activities

This lesson will encourage the students to experiment, observe, question and report their findings in relation to these concepts.

1. Electric current is the movement of electrons through a conductor.
2. Chemicals can produce electricity (dry cell).
3. There are four requirements to a simple circuit.
   A. source
   B. conductors or pathway
   C. load
   D. switch
4. Some materials allow an electric current to flow through them easily and are called conductors.
5. Materials that do not allow an electric current to flow through them easily, if at all, are called nonconductors or insulators.
6. An electrical current produces heat and light (among other things).

Industrial Arts Activities

1. The discovery of materials through actual hands-on experiences.
2. The manipulation of common hand tools.
3. Constructing cooperatively in groups of two students.
4. Develop an appreciation for tools and materials through their successful use.
5. Develop an appreciation and basic understanding of the careers associated with the electrical and graphics areas of industrial employment.
6. Reinforce an understanding on the interdependence of people and machines in our technological society.

VII. Tools and Equipment:

Slip-jaw pliers
Standard screwdriver, 6" blade
Backsaw, 12" blade
Hacksaw, 12" blade, fine teeth
Portable vise (or parallel-hand clamp and C-clamp)
Sawhorse or sturdy table, 24" high
Hand drill
Twist drills, high speed, 1/8, 1/4 and 11/32 diameters
Tinsnips
Mill file, 6 or 8" blade
Exacto knife
Screen printing frame, hinged type
Squeegee, 6 or 8" blade
Steel bench rule, 12" long
Dividers, 6"
Scratch awl
Trysquare, 6" blade
Needle-nose pliers, 6"

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VIII. Materials:

13 dram plastic pill vial, #P-13
Standard "C" dry cell
Flashlight bulb, #14/BP
Round head stove bolt, #6 x 1/2"
#6 nuts for above stove bolts (two per light)
Bright tinplate, 28 to 30 gauge, 3/4" x 3 3/4"
Chipboard, 1 3/4" x 3 1/4"
Hard block of wood for bending jig, 2 1/16" wide
Steel wool, #00
Film for screen printing, lacquer base, 6" x 6"
Blockout or wide tape (shipping or masking)
Lacquer thinner
Mineral spirits
Screen printing ink (mineral spirit base)
1/4" thick masonite, approximately 6" x 6"
Clean cloth
Dowel rod, 1" dia., 10" long

IX. Safety Considerations:

1. Students should wear goggles when drilling, sawing or filing as required by state law.
2. The students should be cautioned to use extreme care when:
   A. working with tinplate in that it has sharp edges.
   B. cutting a design in the screen printing film with an Exacto knife.
   C. using sharp pointed tools such as the dividers and awl.
3. Students should work in pairs in order to assist one another when sawing and drilling.
4. Flammable solvents and inks should be stored in a metal cabinet and metal containers.
5. Rags used for cleaning the screening printing frame which are saturated with ink and solvents should be placed in a metal container with a metal lid prior to disposal.

X. Career Awareness:

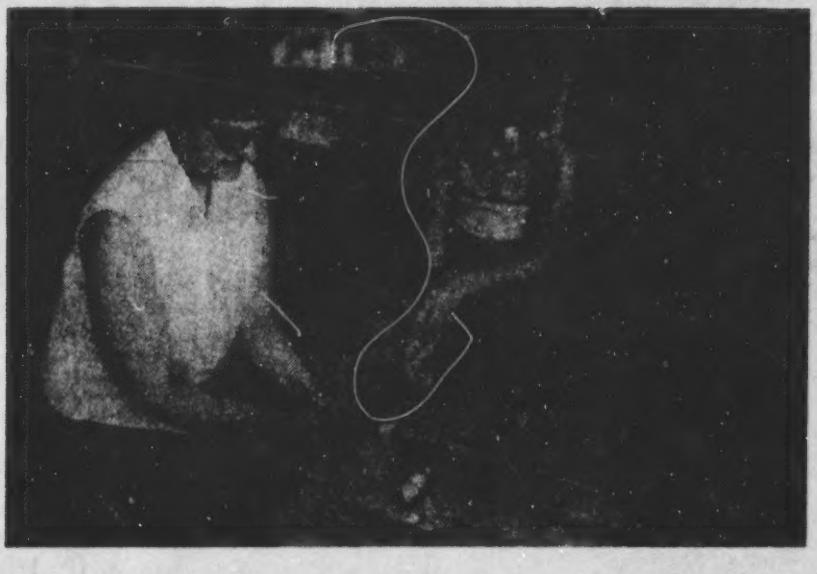
Career awareness can be increased by having the students participate in any or all of the following activities.

1. Conduct an industrial tour of an electrical manufacturing plant followed by a class discussion or written reports.
2. Interview a worker from a local publishing firm.
3. Have each student conduct individual research in the school library and other available resources on the careers of people working for the local power company. One portion of this report should discuss the relationships of these careers and the student's daily living requirements.
4. Identify audio-visual materials that might be available from the Media Center at the local Intermediate Unit on careers in either a graphics or electrical phase of industry. These audio-visual materials can be used in place of an actual on-the-site tour.

XI. Procedure

Body of the flashlight (pill vial)

1. Layout the two saw kerfs to be cut in one side of the pill vial using a bench rule and pencil. While the actual placement of these kerfs may vary from one manufacturer's vial to another, the one near the bottom will be approximately 1/4" from this end. The second kerf will be made 2 1/8" from the first. The length of these two kerfs (measuring across the vial) will be 7/8".
2. Using a portable vise (or parallel clamp and C-clamp), sawhorse, backsaw and one 10" piece of 1" dia. dowel rod as a holding device make these two cuts in the pill vial as pictured below. Place the dowel rod in a horizontal position in the portable vise of holding clamps.



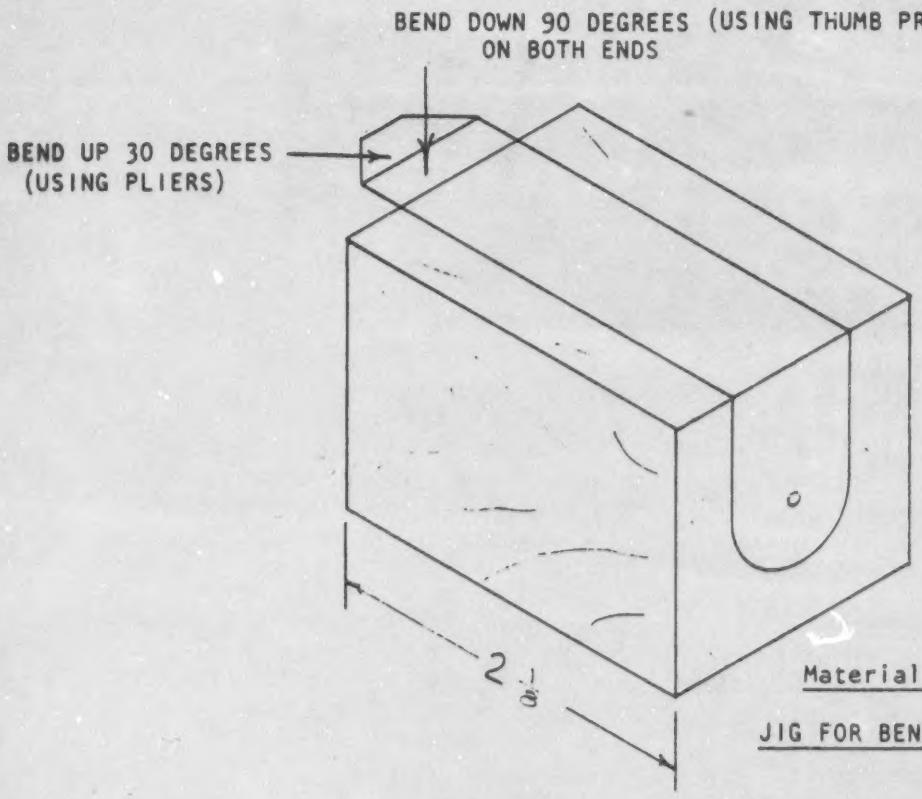
3. Using a hand drill, 1/8" dia. high speed twist drill and the above mentioned vise or clamps, sawhorse and dowel rod, drill one hole in the center of the bottom of the pill vial. Be sure to make a small indentation in the plastic with a scratch awl prior to drilling. Place the dowel rod in a vertical position this time. This operation is also illustrated in the following photograph.

4. Drill one 11/32" dia. hole in the center of the plastic cap from the pill vial. This can best be accomplished by first drilling 1/8" and 1/4" dia. pilot holes. The center of the cap can be located by using a scratch awl and a teacher-made template. An alternate method would include the use of a pair of dividers (or compass) and the intersection of three arcs (minimum) drawn on the top surface of the plastic cap. Be sure to place a piece of scrap wood under the cap to protect the table top. If the 11/32" bit is too large for the available hand drills, this operation can be done by hand using the bit as a reamer to cut the soft plastic. One additional approach would be to secure an 11/32" dia. twist bit with a square end (tang) and turn it with an auger brace.
5. The #14/BP flashlight bulb can be inserted into the 11/32" dia. hole in the plastic cap at this time. The bulb should have a snug fit.
6. It may be necessary to trim the #6 x 1/2" round head stove bolt slightly depending upon the actual dimensions of your available pill vial. Use a portable vise and hacksaw to cut this to the desired length. A small mill file can be used to smooth rough and ragged edges after sawing. A good suggestion might be to place a nut on the stove bolt prior to sawing and filing. A clean-up of the threads will occur when the nut is removed from the stove bolt after these two operations.

Metal switch

7. Layout the metal switch as described in Section IV (see pattern). This can be accomplished using a scratch awl, trysquare, bench rule and dividers. The material needed is 28 to 30 gauge bright tinplate, 3/4" wide by 3 3/4" long.

8. Drill one 1/8" dia. hole in the metal switch as indicated using a high speed bit, hand drill, slip-jaw pliers and a scrap of wood to elevate the piece slightly from the table top. This hole is to accommodate the #6 stove bolt.
9. Using tinsnips cut out the overall shape of the metal switch.
10. Smooth all edges of the switch with a small mill file.
11. Make the two 90-degree bends on the switch using the wooden jig in the following manner.



Material: Hard wood (maple, oak, etc.)

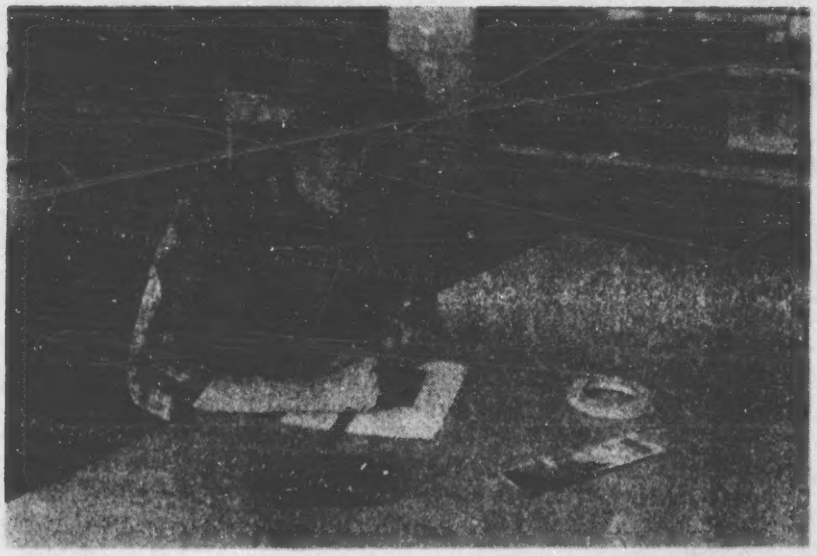
JIG FOR BENDING METAL SWITCH

12. Using slip-jaw pliers, make the one small bend on the bulb end of the metal switch. This bend is located 1/4" from the end and the angle is approximately 30 degrees (which may vary from one pill vial to another).
13. At this time it is now possible to assemble the plastic pill vial and the metal switch (see Section III for exploded pictorial view). A pair of needle-nose pliers and a 6" standard screwdriver are needed to accomplish this task. Be sure to use two #6 nuts; one between the bottom of the pill vial and the switch and one on the other side of the switch to lock it in place.

Chipboard sleeve

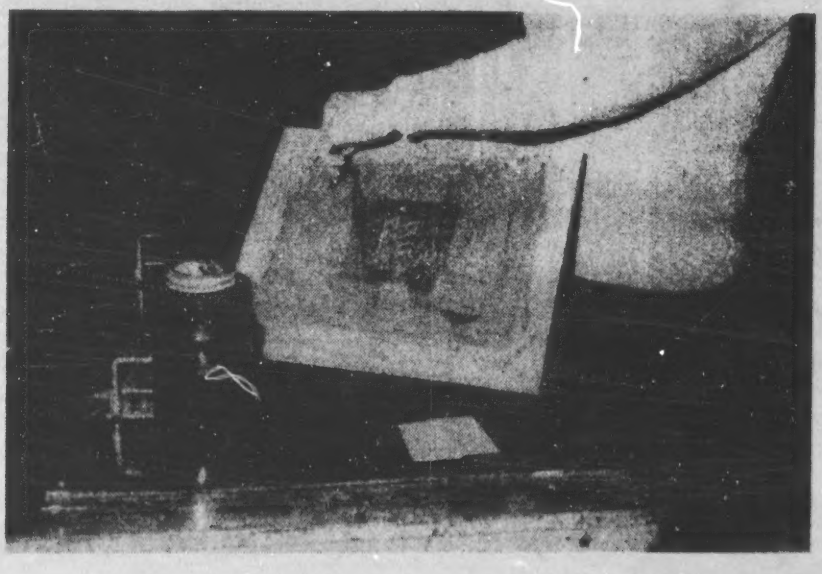
14. Have the class select some name for their pocket flashlights. The example used has been "BIG FLASH." Remember, this final design must physically fit in an area 1 3/4" by 3 1/4".

15. Make a full size drawing of this selected design on a piece of paper.
16. Using an Exacto knife, cut this design from a sheet of lacquer screen printing film approximately 6" x 6". Leave the backing in place while cutting the design. This is illustrated in the following photograph.



17. Attach the film (backing still in place) to the lower side of the screen printing material (near the center). To assist in this operation, place a piece of 1/4" masonite, 6" x 6", under the film to apply even pressure across the screening material. Softly rub the film from the top direction with a clean cloth lightly saturated with lacquer thinner. This will soften the film and permit it to imbed in the screening fiber. Permit this to dry for 15 minutes. Remove the backing at this time.

18. Apply the blockout to the areas of the screen not in use. A scrap piece of chipboard can act as an applicator. Remove all excess blockout and permit this to dry for 15 minutes. Apply a second coat. If lacquer blockout material is not available, one can also use either wide shipping or masking tape to cover the unused portions of the screen. See the photograph below for additional suggestions.



19. Cut the stock for printing from chipboard to the desired size of 1 3/4" by 3 1/4". If chipboard is not available, have the students bring in old cereal or cracker boxes. Cut these to the proper size and use the inside surface for printing.
20. Register one piece of cut stock while it is placed between the hinged portions of the screen printing frame by sighting through the screen and the design cut from the lacquer film. Place several strips on the lower section of the hinged frame for assisting with this registration (placing the image in the proper place). These strips can be two pieces of scrap chipboard attached with masking tape.
21. Leaving the one piece of cut stock in place, lower the hinged screening frame and apply several large tablespoons of screen printing ink to the top surface of the screen material. Using a 6" or 8" squeegee, make a pass over the area of the cut design. Use light pressure and tilt the squeegee 10 to 15 degrees in the direction of travel (usually this is towards the operator). The following illustration has been included for your assistance.

22. Lift the screen and remove the printed stock. Repeat this process until each student has produced his/her own chipboard sleeve. Permit these sleeves to dry for a minimum of several hours.
23. For removing the ink only from the frame, use mineral spirts and paper towels. For total clean-up including the removal of the film from the screen, use lacquer thinner as the solvent.

Final assembly

24. Prior to the final assembly, it would be advisable to clean all contact points on the bulb and dry cell. This can be easily accomplished by rubbing them with #00 steel wool.
25. Wrap the chipboard sleeve around the dry cell and slide both of them down into the pill vial. It may be necessary to bend the metal switch slightly in an outward direction to permit this to happen. Once the dry cell and sleeve are in place, return the metal switch to its proper position.
26. Snap the plastic cap and bulb into place and press the metal switch. If contact is made with the side of the base of the bulb, the circuit should be completed and the result will be "light!"

XII. Final suggestions by the writer:

This project has many additional possibilities such as making it a seasonal activity. For example, a small plastic pumpkin can be attached over the cap and bulb. This and similar items are often available at local craft stores which may be fastened in place with 1/8" pop rivets and metal washers cut from bright tinplate. The designs for the chipboard sleeve can be drawn by each student while using a pencil and felt-tip marker (rather than one design for the entire class and screen printing). The student interest on this pocket flashlight has been very high each time it has been used (JHL).

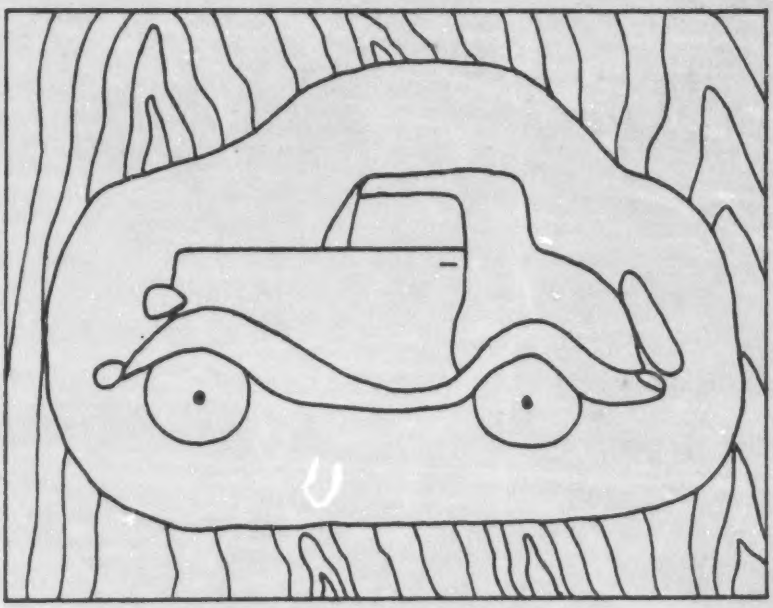
Sample Lesson Plan

I. Name of Activity: A Tribute to Transportation Through Metal Tooling

II. Purpose of Activity:

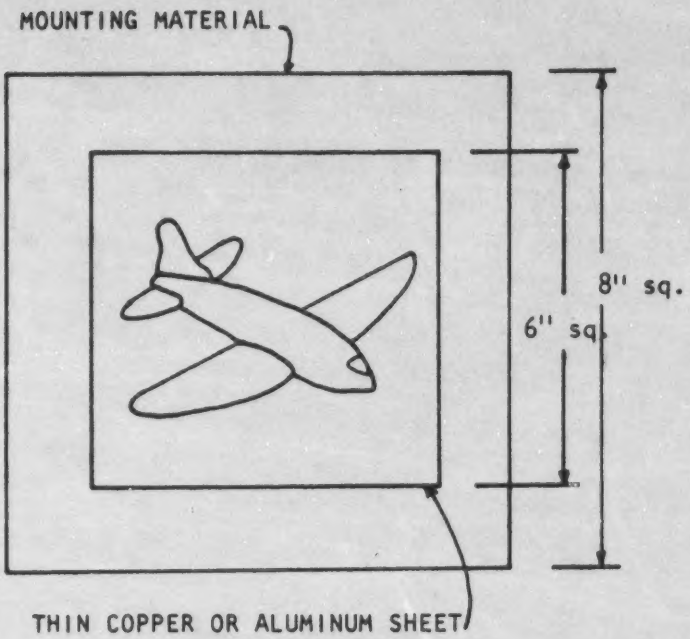
This lesson is designed to spark enthusiasm in the exploration of the various modes of transportation, both past and present. The students can actively participate in a discussion of this nature since transportation involves everyone. A social studies or an art class on the intermediate level can benefit from this effort.

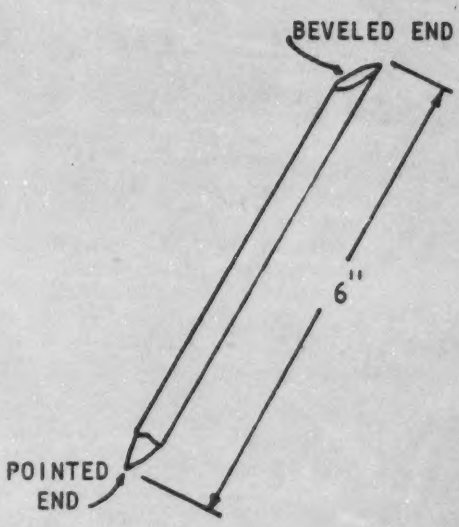
III. Pictorial Drawing:



WOODEN PLAQUE WITH METAL TOOLING

IV. Working Drawing or Pattern





EMBOSSING TOOL MADE FROM 3/8" DIAMETER DOWEL ROD

V. Behavioral Objectives:

The presentation, demonstration and working of the project require about three hours. Upon completion of this project, the students will:

1. Be able to name the four modes of transportation that were discussed.
2. Be able to write a paragraph about any one of the four modes of transportation discussed.
3. Be able to successfully spell such words as embossing, tooling and repoussé.
4. Display a willingness to share such materials as adhering liquid, felt markers and scissors.
5. Display a sense of responsibility when handling such items as cement and scissors.
6. Successfully complete the project within the prescribed time.
7. Display a willingness to participate and actively participate in the clean-up activities.

VI. Application and Acquisition of Skills

Fine Motor Training

1. Cutting a free-form border in copper

VI. Application and Aquisition of Skills (continued):

2. Tracing a pattern
3. Mounting the copper to a frame
4. Outlining a design in copper

Language Activities

1. Researching the topic of transportation
2. Sharing information with classmates
3. Dramatizing the uses of transportation devices

Perceptual Activities

1. Comparing and differentiating the completed projects
2. Reporting on a phase of transportation

Industrial Arts Activities

1. Discovering materials such as copper, lacquer, etc.
2. Manipulating embossing tools and scissors
3. Respecting tools and materials
4. Constructing individually and cooperatively

VII. Tools and Equipment:

Embossing tool (see pictorial), one for each or every two students
One magazine for each student (each can bring one for that class)
000 Steel wool (very fine mesh), one fistfull should be enough for one class
Metal lacquer or clear nail polish to protect the copper from further tarnishing
Scissors

VIII. Materials:

Copper - 36 gauge (0.005" thick) or aluminum of comparable thickness. Allow a six-inch square piece for each student.
Mounting material such as heavy paper, poster paper or wood paneling. Each student will require an eight-inch square piece.
Cement or other adhesive. This depends on the mounting material used.
Patterns of the selected transportation modes.

IX. Safety Considerations:

1. Exercise caution in handling scissors.
2. Depending on the type of adhesive used, adequate ventilation may be needed.
3. Tiny bits of copper may be sharp; handle carefully and dispose of waste properly.
4. If possible, apply lacquer outside the classroom or school building. If inside, be sure to use adequate ventilation.

X. Career Awareness:

At the intermediate level, students should become aware of the training needed for job success. Since this project is strictly a decorative item, questions such as the following may challenge the students: What items in your home are exclusively decorative? Who makes these items? What skills are involved? What type of training do these craftsmen undertake? Are such items saleable? Who might be suited to make these items? Perhaps a local tour of a crafts industry, a timely film or a presentation from a guest speaker could provide these answers.

XI. Procedure:

1. Introduction to the lesson.

   A. Display of the finished project.
      1. Explanation of metal tooling.
         a. Also termed embossing or repousse.
         b. Mainly ornamental work.
         c. Thin metals used.
         d. A change of the metal surface to reflect light at various angles.
      2. New terms.
         a. Embossing tool to stretch the metal.
            (1) Pointed end for outlining.
            (2) Beveled end to smooth and stretch.
         b. Other handy terms.
            (1) Background area of design.
            (2) Image area of design.
   B. Distribution of tools and copper sheets.
      1. Copper sheet (right side up) on magazine.
      2. Selected transportation pattern placed on copper and taped in place.
      3. Trace all lines with the pointed tool.
      4. Remove pattern and turn copper face down.
      5. Embossing tool with beveled end to press image area into the magazine.
         a. Work in one direction only.
         b. Smooth entire area.
      6. With metal right side up, redefine original lines.
      7. Smoothing the background area.
         a. Work on desk top, not magazine.
         b. Work from image area toward outside edge.
      8. Free-form border made by trimming excess background area with scissors.
   C. Mounting.
      1. Decide how the repoussé will appear when mounted.
      2. Apply glue or cement to background area and mount.
      3. Apply lacquer or nail polish to protect copper.

2. Clean-up of all materials.

XII. Final Suggestions by the Writer:

Depending upon the age level of the students, the instructor may choose to pre-cut the mounting frames. With a free-form border there is less problem with centering the copper on the backing, so most students can successfully mount their own pictures attractively. The copper should be pre-cut to allow all students to follow the instructor's demonstration. Caution is needed in handling copper since it can be easily torn (JEB).

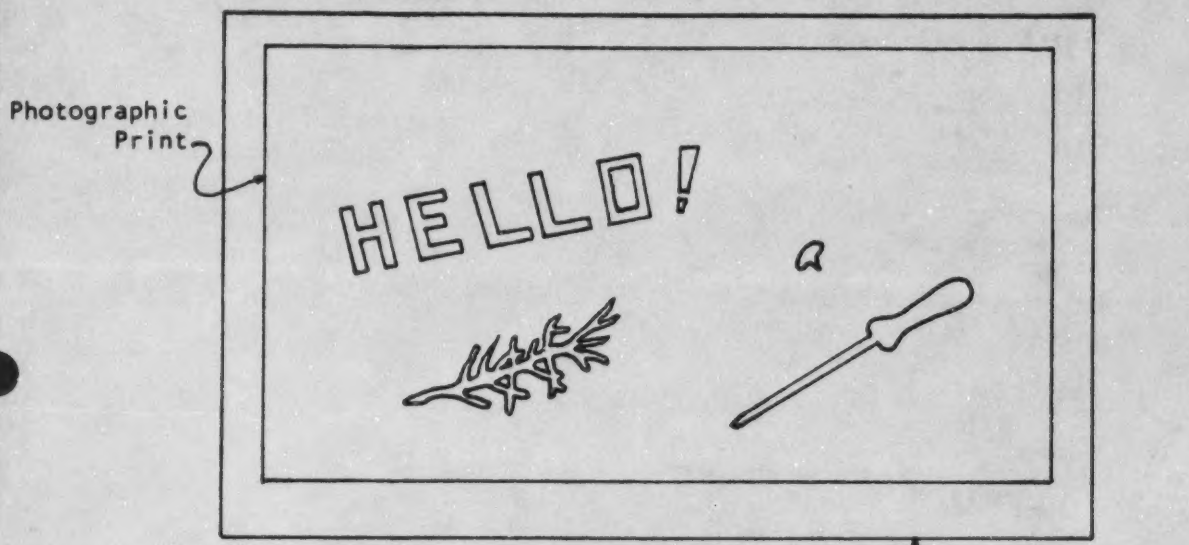
Sample Lesson Plan

I. Name of Activity: The Photogram: A Photographic Technique

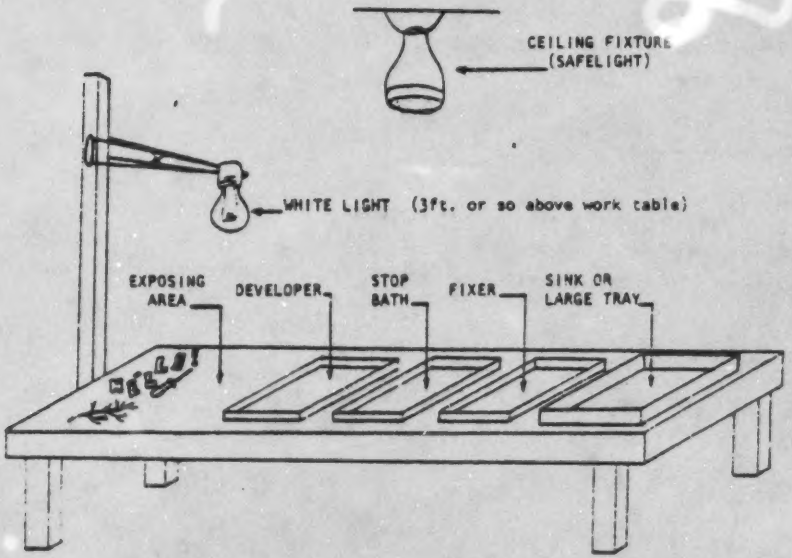
II. Purpose of Activity:

An intermediate-level math or science group will benefit from this demonstration of light effecting a change on light-sensitive paper. From this simple lesson emerges the secret of the camera and how photographs are made.

III. Pictorial Drawing:



IV. Working Drawing:



V. Behavioral Objectives:

The presentation, demonstration and work involve an accumulated time of about one and one-half hours. Upon completion of this lesson, the students will:

1. Be able to identify and discuss such terms as: exposure, photogram, hidden picture, safelight, developer, stop bath and fixer.
2. Be able to outline the sequence for developing the photogram and describe what occurs at each step.
3. Successfully design, expose, develop and mount the photogram.
4. Display a willingness to follow the safety rules established concerning the handling of photographic chemicals.
5. Display a willingness and participate in cleanup activities.

VI. Application and Acquisition of Skills:

Language Activities

1. Reporting on what occurs
2. Naming and explaining new terms
3. Listening to directions
4. Noting relationships of the objects photographed and the finished photogram

Perceptual Activities

1. Organizing materials to be used
2. Identifying chemicals and where they belong
3. Visual perception (adjusting to safelight)
4. Olfactory perception (smell of the chemicals)

Mathematical Activities

1. Relationship of development time to image on paper
2. Relationship of developer temperature to amount of time needed to develop photogram

Science Activities

1. Questioning what occurs
2. Exploring materials suitable for photogram
3. Observing results of explanation
4. Discovering role of time, temperature and chemical strength

VII. Tools and Equipment:

White light source — Red safelight
Table — Water source
Three developing trays (any item that can be used to submerge 5" x 7" sheets)

VIII. Materials:

Photographic chemicals (dektol developer, stop bath and fixer)
These can be purchased in packets for small-scale use
Photographic enlarging paper (one 5" x 7" sheet for each student)
Poster paper
Rubber cement
Blotter paper
Patterns such as letters, buttons, twigs, leaves, etc.

IX. Safety Considerations:

1. If handled improperly, the photographic chemicals can cause injuries. Read all labels and encourage students to do the same.
2. Wear safety glasses when working with chemicals.
3. While working in the dark, have students stand relatively still to avoid bumping into or spilling something.

X. Career Awareness:

Since amateur photography has become very popular in recent years, the instructor may wish to explore with the students the procedures by which photographs are printed. A discussion of necessary skills for the various jobs in a developing plant can enlighten the students. Perhaps a film on photography and its related careers or an interview with a photographer will add interest to the lesson.

XI. Procedure:

1. Introduction of new terms.

   A. Photogram - a photographic print made without the use of a camera or a film negative.
   B. Exposure - the time in which the photographic paper is subjected to white light.
   C. Hidden Image - the invisible picture on the paper after it is exposed. This becomes visible when put through the developing process.
   D. Safelight - a red or amber light that can be used without exposing the photographic paper, (this color depends on the paper used).
   E. Developer, Stop Bath, Fixer - chemicals used to make the hidden image visible and harden the surface to prevent fading of the photogram.

2. Explanation of the process of exposing the photogram and demonstration.

   A. Adjustment to working under safelight conditions.
   B. Photographic paper - place on the easel (or put paper on

XI. Procedure (continued):

the table directly under the white light source if no easel is used).

C. Items for design placed on the paper.
D. Expose the paper for ten seconds (can ask students to count aloud).
E. Remove design items.
F. Place exposed photo paper in developing tray, rocking tray slightly until image areas appear dense black.
G. Photo is then placed in stop bath for fifteen seconds to stop the developing action.
H. Photo is placed in fixer for ten minutes to harden the surface.
I. One-half hour wash is needed to remove all chemicals. Place photo between blotter papers to dry.

3. Discussion of the process and career education.

A. Photographic paper containing silver halides suspended in gelatin.
B. Tarnishing results from exposure to white light.
C. Developer displays this tarnishing as black on the paper.
   1. Areas covered during exposure remain white.
   2. Covered areas that allow some light to leak through (such as a leaf to be used for a design) should be developed as shades of gray.
D. Questions concerning the qualifications of people who work in developing plants (such as the Fuji or Kodak Companies and private photographers) and the demand for their services.

4. Exposing the photogram (each student making her/his own design).

A. Follow procedure outlined above in demonstration.
B. As one student exposes a photogram, have two others creating their designs (keep all photographic paper covered until ready to be exposed).
C. Allow all photograms to dry thoroughly after water wash (overnight drying is preferred).

5. Demonstration of mounting the photogram.

A. Select colored poster paper (The teacher may wish to have these precut to 6" x 8").
B. Use ruler and mark guidelines to easily center the photogram on the mounting.
C. Apply rubber cement to photo back and mounting inside guidelines.
D. Press photo and background material tightly together. Permit this to dry while removing any excess cement.
E. Clean up all materials used.

XII. Final Suggestions by the Writer:

When purchasing photographic paper, look for larger sheets such as 8" x 10" which can be cut to size. Obtaining paper in this way is less expensive. A photographic supply dealer can provide information concerning the amount and type of chemicals needed (JEB).

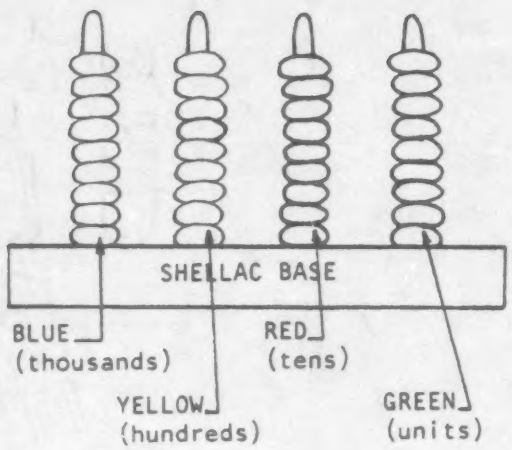
Sample Lesson Plan

I. Name of Activity: Abacus: "An Old Math Friend"

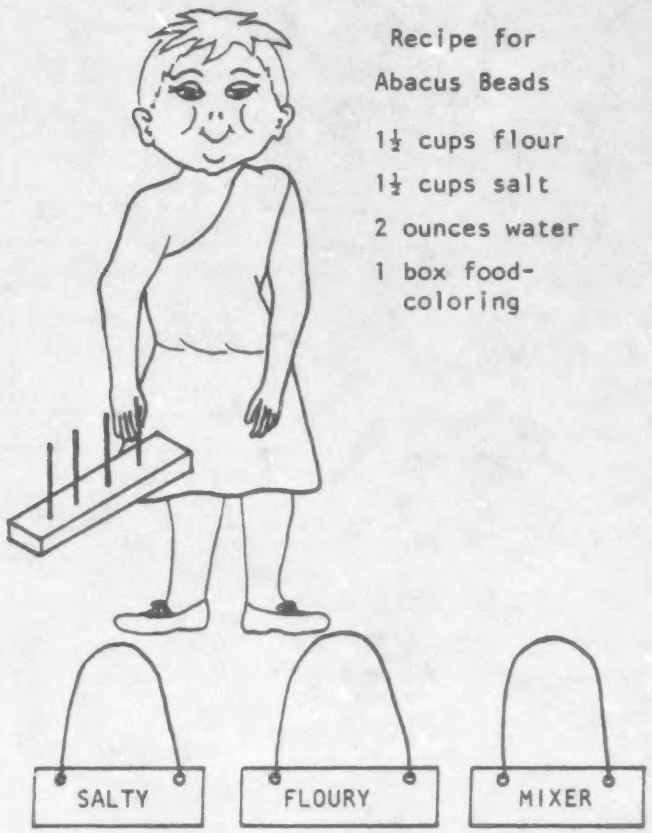
II. Purpose of Activity:

The student can construct an aid to develop the concept of ten. This can be used to illustrate any number from 1 to 9999 in the study of mathematics in the primary grades.

III. Pictorial Drawing:



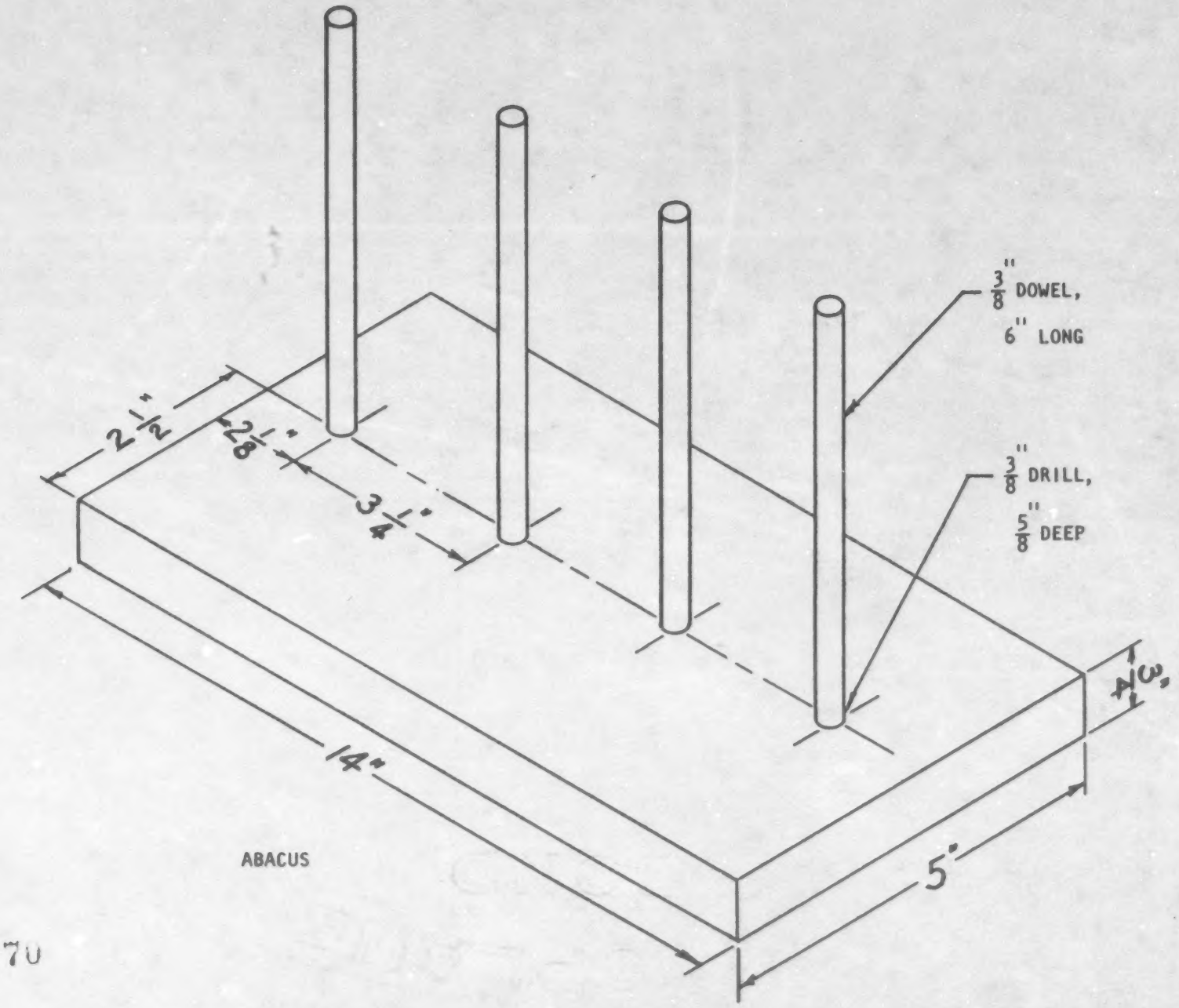
THE EARLY ABACUS:



Recipe for Abacus Beads

1½ cups flour
1½ cups salt
2 ounces water
1 box food-coloring

Signs student should wear while doing their job.



ABACUS

V. Behavioral Objectives:

As the result of this lesson, each student will be able to:

1. Construct an open-end abacus in three class periods.
2. Comply with the established safety rules.
3. Identify such terms as dowel, abacus and calculator.
4. Write a brief story (two or three sentences) regarding the use of the abacus.
5. Use the abacus constructed as a concrete means for checking answers to problems in mathematics.
6. Discuss mass production, its advantages and disadvantages.

VI. Application and Acquisition of Skills:

Gross Motor Training

1. Sawing dowels to correct size
2. Drilling holes in base
3. Hammering dowels into place
4. Rolling salt and flour dough

Fine Motor Training

1. Writing a short paragraph about the abacus
2. Sanding all the parts
3. Painting (4 colors - blue, yellow, red and green - each dowel a different color)
4. Gluing dowels in place.
5. Applying desired finish (for example - shellac) on board

Language Activities

1. Listening to the early history of the abacus
2. Reacting to the value of the early abacus and realizing how it can be applied to math today
3. Deciding on a method of making a substitute for beads, which would be less expensive (salt, flour and water)

Perceptual Activities

1. Measuring and comparing distances for the four holes

Industrial Arts Activities

1. Discovering materials
2. Manipulating tools
3. Respecting tools and materials
4. Constructing cooperatively an aid for use in mathematics

VII. Tools and Equipment:

Brace and bit, #6 (3/8")
Vise
Coping saws
(2) bowls, (2) large spoons
Rolling pin and board
Classroom oven
Thimble (cutter)

Visual Aids:

Sample abacus
Information sheet
Bulletin board
Overhead transparency

VIII. Materials:

Wooden bases 3/4" x 5" x 14"
Wooden dowels 3/8" diameter
Glue
Abrasive paper
Abacus beads (salt, water, flour and food coloring - blue, yellow, red and green)

IX. Safety Considerations:

1. Make sure the vise is clamped firmly to the table.
2. Point the saw toward the floor when sawing.
3. Watch fingers while sawing.
4. Handle long dowels with care.
5. Finishing operations should be performed in a well-ventilated area.

X. Career Awareness:

1. The student will acquire knowledge and skill in work performance through practice. Through these manipulative and research experiences, the student will have the opportunity to identify and develop individual skills. Presenting the abacus will stimulate student curiosity and reward individual investigations.
2. Resource people could be brought in to speak (such as the storekeeper, the carpenter and specialized laborers).

XI. Procedure:

1. Introduction

   A. This person who lived 7000 years ago may have looked like this drawing.
   B. When they worked simple addition and subtraction problems, they used their fingers.
   C. Later, persons used pebbles to show numbers larger than ten.
   D. This system was too bulky, so they assigned special values to pebbles. A different color represented each value - ones, tens, hundreds and thousands.

XI. Procedure (continued):

E. Later, each person kept their beads on posts to be used again and again.
F. Sometimes they used kernels, beads or shells for their abacus.
G. The abacus worked so well for these early people that it remained popular.
H. Information sheet distributed and read aloud.
1. New words pronounced and explained.
2. Assignment given to write a short paragraph.
3. Abacus assignment from the math book is given (correlation).
I. Sample project displayed.

2. Lab work performed in groups of three.
A. Measure and cut out base to correct size - 3/4" x 5" x 14".
B. Measure and cut four dowels, 6" long.
1, Be sure vise is secure.
2. Watch fingers while cutting.
C. Mark layout lines and drill four holes in the base 3/8" in diameter.
1. Position base so it can be drilled clear through.
2. Hold drill horizontally for a straight hole.
D. Sand all pieces, noting the direction of the grain.
E. Assemble the abacus and place student's name on the bottom.
F. Apply paint or sealer.
1. Color on post should correspond with food coloring used in making the bead.
2. Use paint in well-ventilated room.
3. Apply thin, successive coats of paint.
G. Students work in groups of three to make the beads.
1. Salty adds the salt.
2. Floury adds the flour.
3. Mixer blends the needed ingredients and adds needed water.
4. Salty pours the mixture onto the board.
5. Floury rolls the dough. The instructor adds the food coloring making four different color balls to match the dowel pins.
6. Each student cuts out thirty-six beads and places them on the baking sheets.
7. The instructor times and bakes the colored beads until thoroughly dried but not brown.

XII. Final suggestions by the writer:

The open-end abacus made by each student is especially valuable since each is proud of the workmanship and the achievement of learning new skills. Always be sure that each child has her/his own abacus to use in future classes. They enjoy "playing teacher" or calling out a number less than 9999, while the remainder of the class places their colored beads on the ones, tens, hundreds or thousands places to illustrate the number. Use this aid to check a student's understanding of the process by having each demonstrate that the answer to the problem is

XII. Final suggestions by the writer (continued):

correct. Making the beads from common household materials such as salt, flour, water and food colorings interests the students and is less expensive than purchasing beads from a crafts store or cutting squares of wood and drilling them. The abacus is a favorite aid of mine for use in a remedial or low-level math class where the children need to manipulate and use a concrete means for working and checking mathematical problems (MCC).

Sample Lesson Plan

I. Name of Activity: The construction of a portable puppet stage and hand puppets for use in a primary reading class.

II. Purpose of Activity:

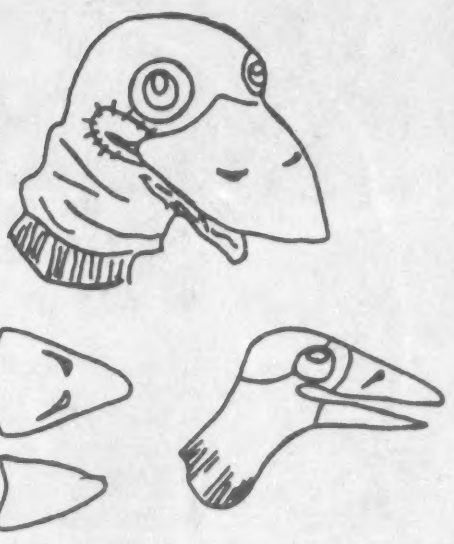
Reading skills will be challenged as the student enjoys planning and giving a puppet show to classmates. This activity will provide an opportunity to develop the student's ability to work within a group as well as display their creativity as each makes a puppet to portray a chosen character. In addition, making a puppet stage and puppets will utilize materials common to the classroom or easily found outside the classroom.

III. Pictorial Drawing:

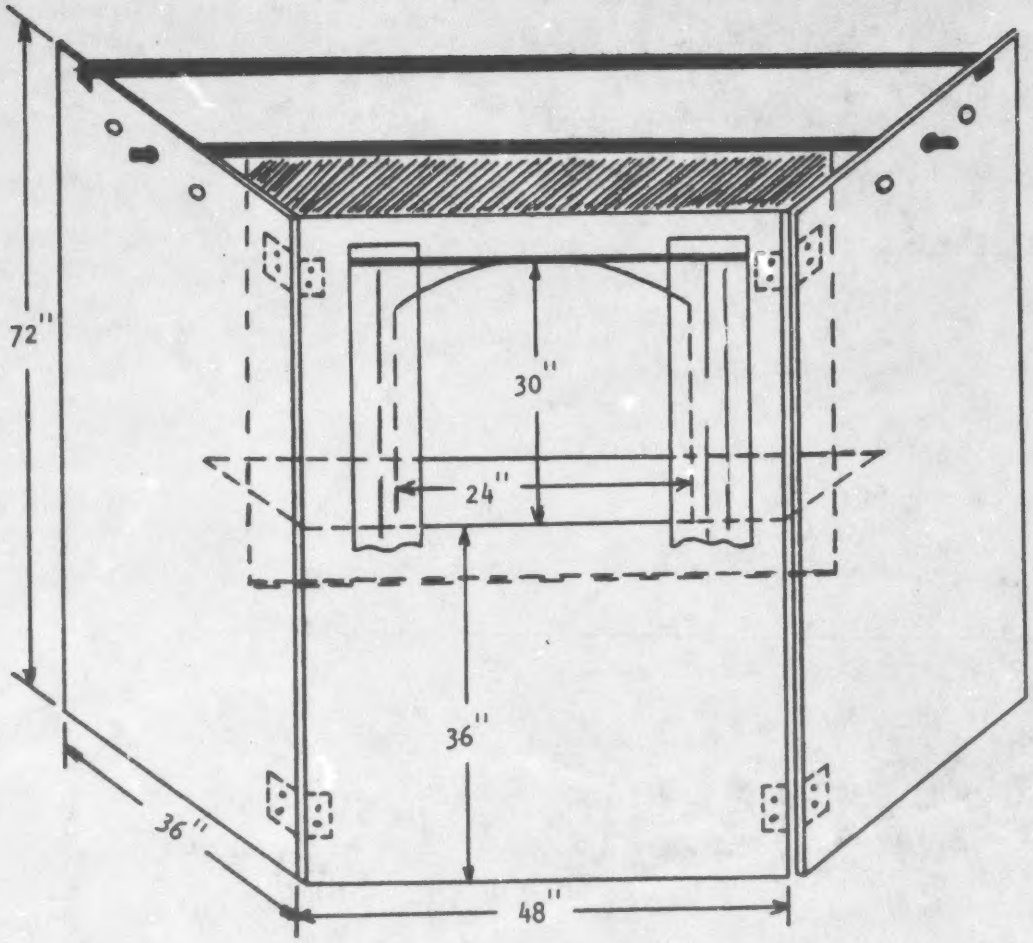
1. Stocking Dragon

2. The Perky Pup

3. Old Joe Crow



IV. Working Drawing:



A PORTABLE SCRIM STAGE

V. Behavioral Objectives:

As the result of this lesson the student will be able to:

1. Correctly pronounce all the words found in the story, "The Lazy Dragon".
2. Actively participate in the construction of a hand-stocking puppet to be used in the show.
3. Pretend and perform the role of a character or animal.
4. Hold the attention of the classmates by speaking clearly.
5. Make the show as simple as possible with "plenty of action" to create audience interest.
6. Construct a portable scrim stage and hand puppets from used, easily accessible materials.
7. Write and perform many different shows with knowledge of how to construct puppets and a stage for use on a rainy day or any special occasion.

VI. Application and Acquisition of Skills:

Gross Motor Training

1. Sawing cardboard for the stage

Fine Motor Training

1. Writing the show from the story
2. Painting scenery and exterior of stage
3. Cutting gauze and felt
4. Sewing puppets
5. Gluing sock material when making puppets
6. Fingerplay in sock puppets

Language Activities

1. Deciding the appearance of a particular character
2. Deciding which puppet to portray
3. Listening to a classmate play the role of a certain character
4. Dramatizing and roleplaying

Perceptual Activities

1. Comparing student's puppet to a picture or model for realistic features
2. Identifying the correct tools and materials needed to construct the puppet

Industrial Arts Activities

1. Discovering the use of everyday materials to construct a worthwhile project for use in a given subject area (reading)

VI. Application and Acquisition of Skills (continued):

2. Manipulating safely tools such as the keyhole and coping saws
3. Learning the importance of measuring accurately
4. Constructing both individually and cooperatively this particular project
5. Discovering the importance of good safety habits
6. Respecting the care of tools and materials while returning them to their correct places
7. Participating as a member of the class in clean-up activities

VII. Visual Aids, Tools and Equipment:

Bulletin board
Model puppet
Paint brushes and paint trays
Keyhole and coping saws
Rulers and yardstick
Three curtain rods
Needles (large eye)
Scissors

VIII. Materials:

Puppets (for the story, "The Lazy Dragon")

White socks
Black and brown magic markers for the pup
Thread
Red cloth or felt for mouth and crest
Buttons (black or brown) for eyes or eyes used in making stuffed toys
Green and black socks for dragon and crow
Quick-drying household cement

Puppet Scrim Stage

Refrigerator carton or large sheets of cardboard
Duct tape, 3" wide
Heavy gauze
Tempera paint

IX. Safety Considerations:

1. Use care while distributing pointed objects.
2. Be careful while using needles to sew puppets. When sewing is finished, place needles point-down in the needle holder or pin cushion.
3. Quickly replace the cap when using household cement.
4. While cutting the gauze with scissors, be careful not to cut anything underneath the gauze.
5. Wear a shop apron or cover over clothing when painting scenery and outside decorations on the puppet stage.
6. Wear proper eye protection when sawing.

X. Career Awareness:

The students will be involved in learning to communicate more effectively with one another and to respect each other's ideas as the puppet show is planned by the class. They will become more aware of different personalities when acting out the roles of various characters in the form of puppets. They will realize the importance of skill as it influences people who see the puppets and the puppet stage. They will experience the feeling of a "job well-done" and personal satisfaction when the audience responds with pleasure.

XI. Procedure:

1. Introduction to the lesson.

   A. Read and discuss the story, "The Lazy Dragon".
   B. Showing a model puppet, name the character and discuss the characteristics of each.
   C. Divide the class into groups, permitting the students to participate in the activities they prefer, such as:
      1. Making puppets.
      2. Working on the stage.
      3. Writing the show in sequence.
   D. Identify and demonstrate the use of each tool.

2. Making the puppets.

   A. Stocking Dragon (see previous illustration under Pictorial Drawings)
      1. Select a clean green sock.
      2. Thrust your hand inside as shown, keeping fingers together to form the upper part of the mouth with the thumb lowered to form the lower jaw.
      3. Poke the toe of the stocking back into your hand to form the mouth.
      4. Sew across the fold at each corner of the mouth to hold it in place.
      5. Line the mouth with red felt.
      6. A forked tongue can be added.
      7. Practice making the flexible mouth grin comically, smirk and turn down grumpily.
      8. Eyes are buttons on circles of felt.
      9. The crest is felt cut and sewed along his spine, which is the back of your hand and wrist.
   B. The Perky Pup (see previous illustration)
      1. Use a brown or black speckled stocking and add the pup's floppy felt ears.
      2. For droopy eyes, first sew on bright black buttons, then cup a half-circle of felt over them and sew it down.
      3. For a nose, add a big button or black cloth in a bulb shape.
   C. Old Joe Crow (see previous illustration)
      1. This bird has a bill of cardboard in two parts.
      2. The sock is prepared as before, with the folds at the corners wrapped, then the upper and lower bills are glued in place.
      3. Use cement to secure the bill with your hand inside the sock, holding it firmly in place until dry.
      4. For eyes- use buttons, sequins or the eyes purchased in craft stores (as used on stuffed toys).

References:

This Puppet as an Actor by Hans J. Schmidt, The Coach House Press, Inc. 1959.

XI. Procedure (continued):

101 Hand Puppets by Richard Cummings (Guide for Puppeteers of All Ages), David McKay Company, Inc., New York, 1952.

3. Making the portable scrim stage.

A. The three-screen stage can be made from a refrigerator box or any comparable large size sheets of cardboard.
B. Lay out as indicated in the drawing.
C. Cut the cardboard with small panel saw.
D. The three frames are hinged together with duct tape as to aid in its transportation.
E. A bar across the back locks the screens into position when in use.
F. The masking material of cloth can be permanently tacked to the frames or draped.
G. The playboard should be about six-inches wide and placed in the opening so that half 's inside of the stage. Properties may be clipped to the back edge of the board while the curtains are closed in front.
H. For the draw curtains, use standard drapery tracks or dowels.
I. Lighting is best placed outside the proscenium.
J. The rod from which the scrim hangs should be movable in a forward direction which permits the props on the playboard to be manipulated.
K. Background scenery can be painted on the scrim with poster paint. These can be varied by the use of any number of removable scrims, each with its own supporting rod.

XII. Final Suggestions by the Writer:

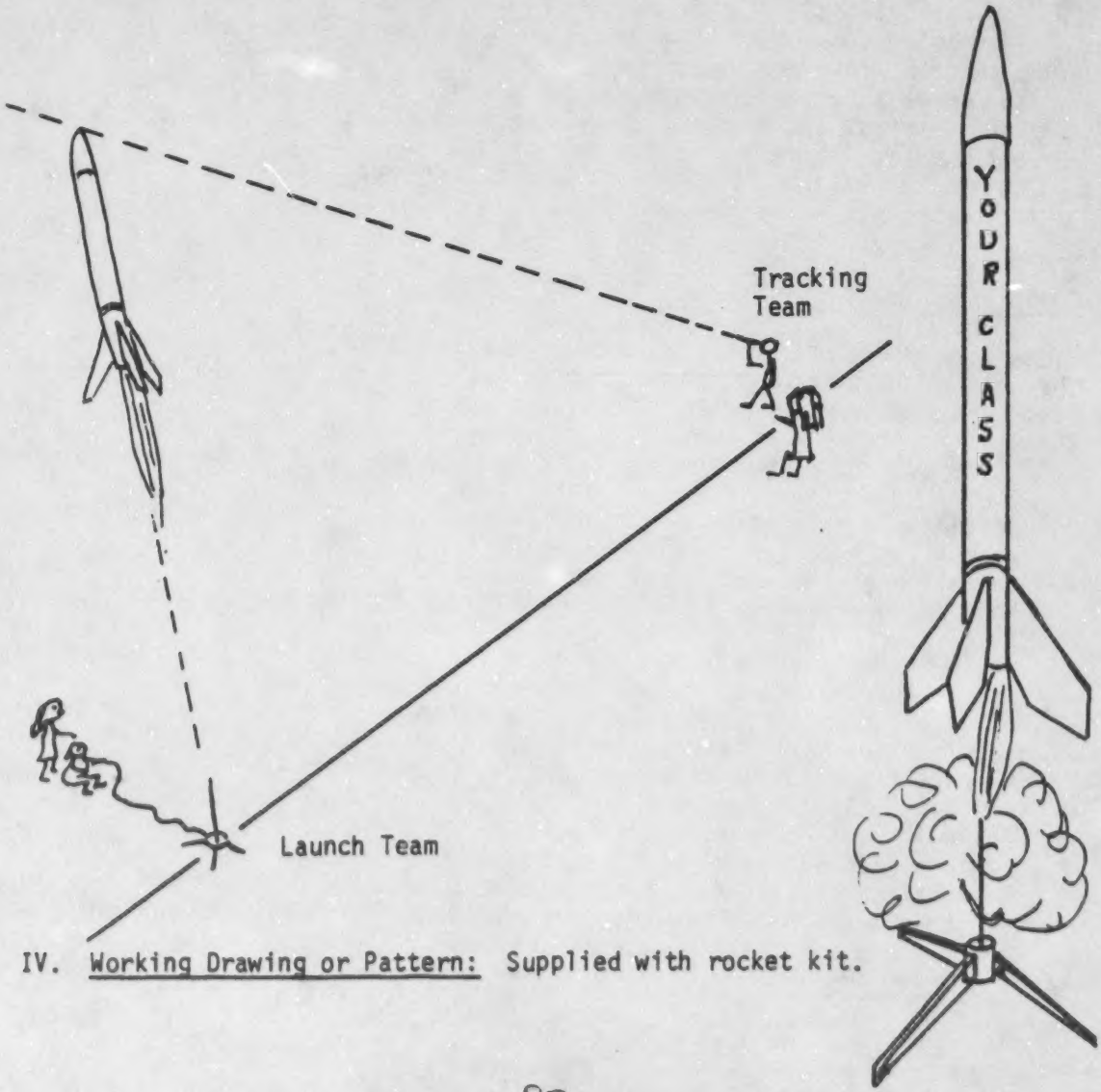
The great advantage, I have found, of this type of stage is that the operator has direct vision of the puppet and props through the scrim. However, it has to be a shallow stage and cannot be wider than shown in the illustration. Duct tape works very well for hinges. Using socks the same color as the animal saves a great deal of time. Teach the students to thread needles and practice sewing on scraps of material prior to this lesson. Plan the necessary backgrounds before attempting to paint them. Student cooperation and listening to instructions are essential in completing the puppets, puppet stage and presenting the puppet show(MCC).

I. Name of Activity: MODEL ROCKETS

II. Purpose of Activity:

Understanding rockets and space travel is as important for today's children as learning how people benefited from air and surface transportation was for their parents. Intermediate children can successfully build and fly model rockets. Science, mathematics and communication skills can all be included.

III. Pictorial Drawing or Photograph:



IV. Working Drawing or Pattern: Supplied with rocket kit.

V. Behavioral Objectives:

During the model rocketry lessons students will have opportunities to:

1. Discuss the social changes due to rockets and satellites in today's world, and in the future. Some examples might be the use of satellite pictures to make the weather maps shown on television news programs, or satellite relay of radio, television and telephone communications from around the world. Today we have greatly improved knowledge of the planets in our solar system due to rockets carrying instruments. In the future rockets may carry people to the planets and beyond.
2. Individually, or as a group, construct a model rocket.
3. Learn how each of the major components contributes to a rocket's flight: structure (nose cone, body tube, payload section); guidance (fins, launch lug and rod); propulsion (solid fuel reaction engine); launch system (igniter, electrical launcher); recovery (parachute, streamer or other) and tracking (observing flight, judging altitude).
4. Observe or participate in a model rocket launch.
5. Apply related science and mathematics concepts. Use weather vane and anemometer to measure wind direction and speed. These instruments can be made by children or borrowed from the science department. Use metric and/or customary measurements. Rocket body tubes, prelaunch weight and engine thrust are measured in metric units. Tracking range and rocket altitude may be metric or customary distances. Flight time can be determined accurately with a stopwatch borrowed from the gym teacher or coach.

VI. Application and Acquisition of Skills:

Elementary children can participate in model rocketry in a number of ways. They can a) build rockets from raw materials such as paper, balsa wood, etc; b) assemble model rocket kits, or c) use model rockets built by others. This sample activity will describe building and flying model rocket kits which are available from several sources. The skills developed will include:

1. Reading and discussion of current newspaper and magazine articles about rockets.
2. Selection of the rocket(s) to be built. Kits are rated by skill level. Most beginner level kits would be appropriate for intermediate grade children.
3. Following written and pictorial directions supplied in the kits. Note: the teacher may have to check reading level and vocabulary. If necessary, the directions can be rewritten or interpreted by the teacher.
4. Construction skills may include cutting or pressing out paper and balsa wood parts, sanding, glueing, painting and patience. Waiting until glue or paint dries is the most difficult part for many children.
5. Following oral directions, especially on launch day.
6. Learning and observing simple launch safety procedures.
7. Observation of wind direction and speed.
8. Direct measurement of tracking range (about 400 feet) and indirect measurement of rocket altitude (up to 1000 feet).

VII. Tools and Equipment:

Scissors
X-Acto knife or single edge razor blade
Sandpaper
Six or twelve-volt battery (auto battery may be used without removal from car)
Electrical launch system (this can be borrowed, some have batteries included)

VIII. Materials:

Model rocket kit(s) May be obtained in many hobby shops.
White glue
Paint for paper and wood parts
Rocket engines (they are used only once, rocket can be flown many times)

IX. Safety Considerations:

Care in cutting with sharp knife. Some kits have press out parts and need no cutting.
Learn and use Model Rocketeers Safety Code; available from the vendors of the rocket kits.
Launch rockets only when there is little wind so they won't drift onto roofs, roads, etc.
Teacher should supervise connecting launcher to battery.
Connect launcher to ground terminal of battery first; disconnect ground last when removing launcher.

X. Career Awareness:

Today hundreds of thousands of people work in industries which produce rockets, satellites, communications equipment, scientific instruments, chemical fuel and many other things related to peaceful uses of space. Millions more work in careers which use information and techniques developed in space related industries. Every child in your class will be affected by space industries of the future. Some of them will live in space.

XI. Procedure:

1. Build the rockets following the directions included.
2. Organize the class for launch day duties, for example:
   a. Range safety officer (teacher or responsible student)
   b. Rocket launch team (when all is ready they count down and press launch button)
   c. Tracking teams - may have several teams - They spot launched rocket and measure angle of elevation at highest point.
   d. Down range recovery crew - they observe from a safe location the rocket's trajectory to its point of soft landing. Then they go to pick it up and return it to the launch area. If all children are permitted to run after the rockets both rockets and children may get trampled.

XI. Procedure (continued):

3. Calculate rocket's altitude from the average angle of elevation reported by the tracking teams. There are simple charts for this.
4. If desired, distance and direction from launch pad to landing area can be measured. Time of flight (launch to landing) can be measured and used to calculate ground speed.

XII. Final Suggestions by the Writer:

When painting rockets choose colors which are highly visible against blue (sky) and white (cloud) backgrounds. In most communities there will be older students and adults who are experienced model rocket builders. They will have equipment and experience to share. Wherever you buy model rocket kits these community experts will be known. Use them as resource persons when you first involve your class in this exciting way to learn (DJF).

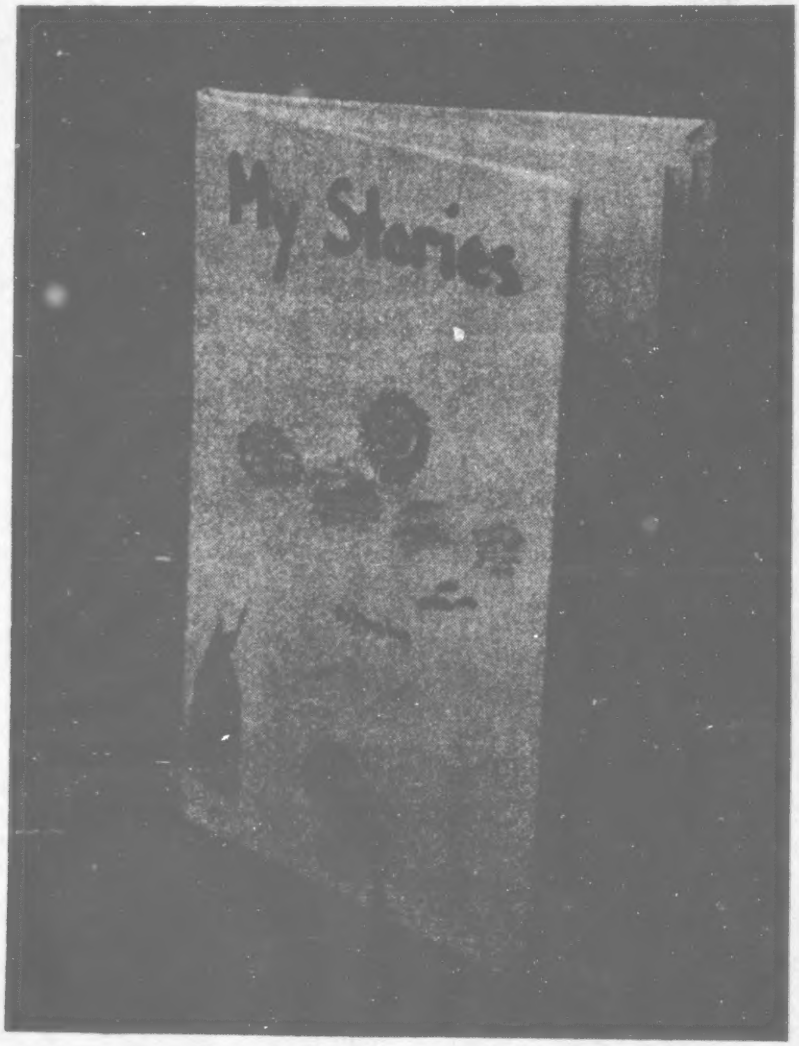
Sample Lesson Plan

I. Name of Activity: Visual Communications "Bookbinding"

II. Purpose of Activity:

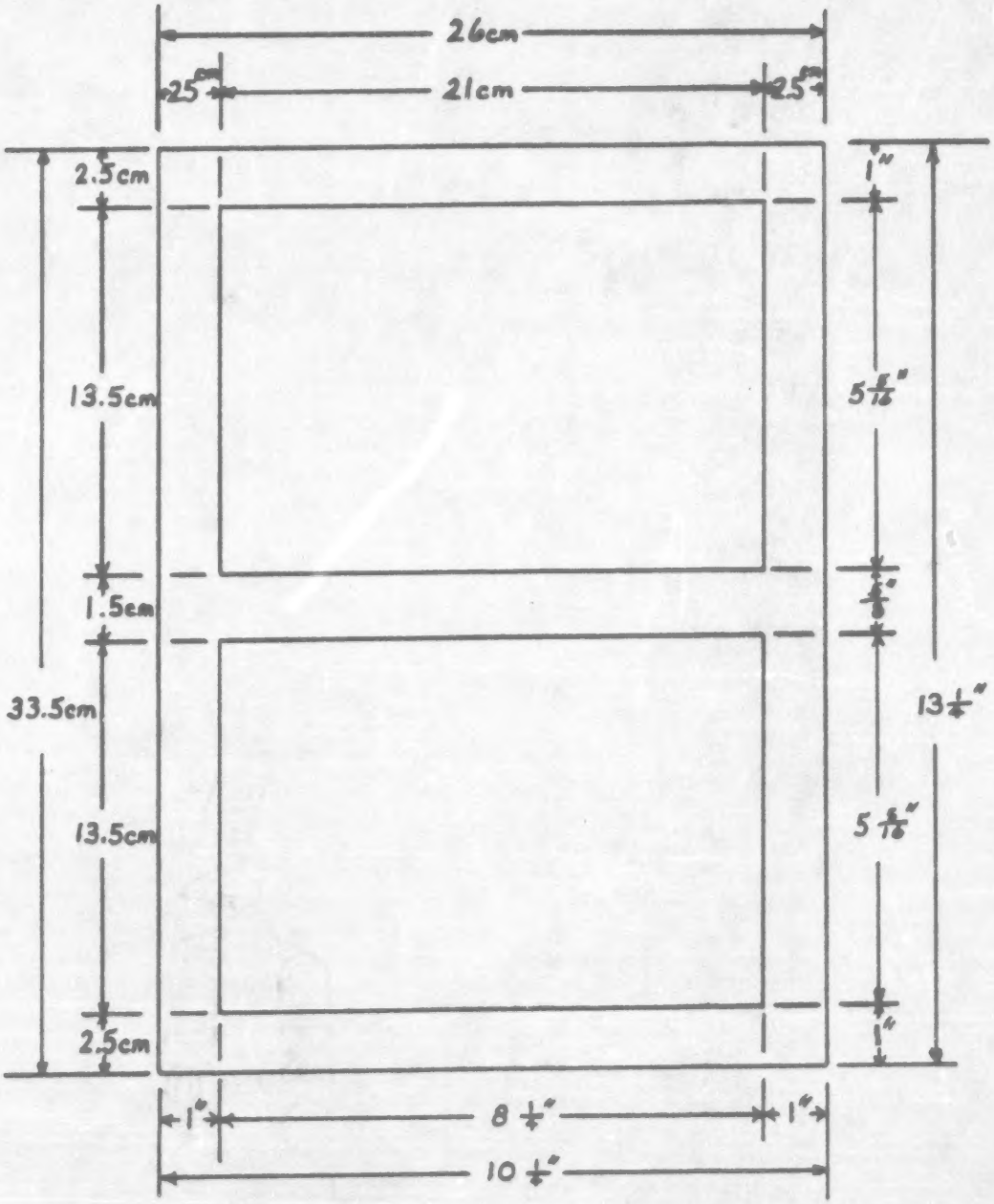
This intermediate grade level activity is designed to provide students with the experience of binding individual sheets of paper into a finished book. The book can be used for stimulating creative writing, writing a diary or simply keeping notes and would become an instructional material to be used in the classroom and at home.

III. Pictorial Photograph:



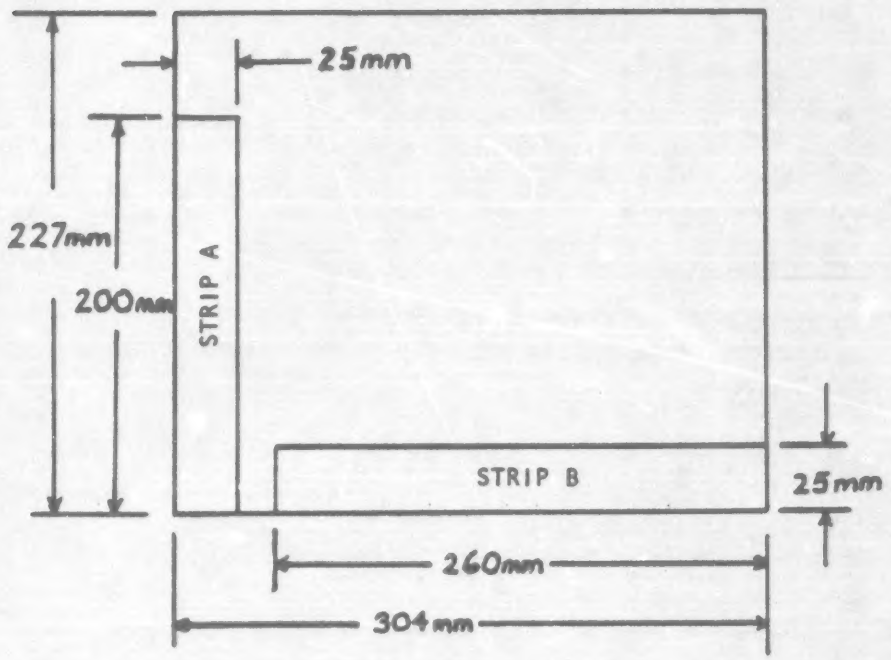
IV. Working Drawing and Pattern: (to be made by the teacher)

COVER PATTERN



IV. Working Drawing and Pattern (continued):

FOLDING BOARD
(OAK TAG)



NOTE:

GLUE STRIP A AND B IN PLACE.

V. Behavioral Objectives:

These intermediate-level students will have two forty-minute lessons during which they will:

1. Identify and discuss various broad occupational areas related to the publishing industry.
2. Fold individual sheets of paper into signatures and sew them together to form the pages of a book.
3. Design and make a hardback cover for the book.
4. Attach the cover to the pages of the book.
5. Discuss the quality of their own efforts.

VI. Application and Acquisition of Skills:

Gross Motor Training

1. Hitting the awl to perforate the signature
2. Pulling and twisting the awl to remove it from the signature

Fine Motor Training

1. Folding the signatures and cover paper
2. Tracing the shape of the book cover and assembling parts using glue
3. Sewing the signatures together and tying remaining thread end in a knot

Language Activities

1. Listening to directions
2. Reacting to directions

Industrial Arts Activities

1. Constructing a book individually
2. Discovering materials (binders board, gauze, glue, etc.)
3. Safely manipulating scratch awl and sewing needle

VII. Tools and Equipment:

Paper cutter
Scissors
Scratch awls
Folding boards (one per student)
Tapestry needle (one per student or large-eyed sewing needle)
Book cover templates (four per class)

VIII. Materials:

Each student will need:

10 or 12 sheets of 8" x 10½" white composition paper lined long way with lines 1/2" or 3/8" apart. Plain white paper can also be used.

VIII. Materials (continued):

2 pieces of binder board 5 1/4" x 8 1/8" (130mm x 205mm) This can be new or made from old book covers with the book cloth removed.
1 small container of white glue
24 inches of heavy sewing thread
1 piece of white drawing paper 12" x 18" (304mm x 456mm)
1 piece of clear contact paper 10 1/4" x 13 1/4" (26cm x 33.5cm)
1 piece of bandage gauze 3" x 6" (7.5cm x 15cm)
1 piece of stiff cardboard 2" x 3" for spreading glue
1 half sheet of newspaper on which to do the gluing
2 sheets of white drawing paper 8" x 10½" for fly pages (202mm x 266mm)

The teacher will need:

1 piece of heavy cardboard 8" x 10" (20cm x 30cm) This can be made by gluing a number of pieces together.

IX. Safety Considerations:

1. Care should be exercised when students are sewing. Each student should work at her or his own desk.
2. The teacher should hold the scratch awl and book as each student forces the awl through the signatures.

X. Career Awareness:

The teacher could introduce this activity by relating the fact that in ancient times all books were hand-made and that what they are going to do is essentially the same process. Today, however, almost all the hand processes are done by machines. Many occupations exist in the publishing industry from the writing of an original manuscript to the reading of it, revising of it, printing, binding and finally the marketing of a book. The whole area of publishing could be studied in greater depth depending on the teacher's objectives and the interest of the students.

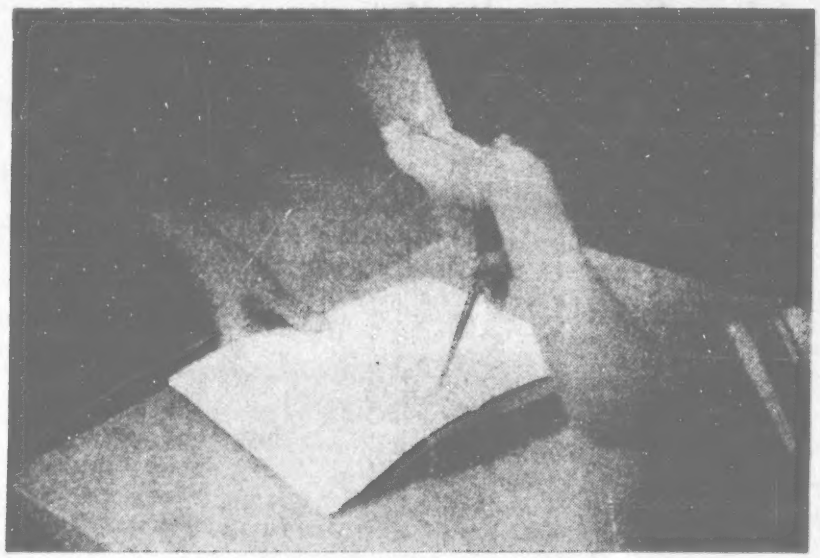
XI. Procedure:

1. Distribute one folding board, 2 sheets of unlined drawing paper and twelve sheets of lined paper to each student.

2. The students are then given a demonstration on folding papers for the signatures. To have the students fold the paper accurately, they should use folding boards. To fold properly, place one long edge of paper against the bottom stop of the folding board, then slide the paper over to the stop on the left side of the board. Lift the right edge of the paper and fold it over toward the left side of the folding board until the edge rests against the stop. At this time, fold the sheet tightly in half. All sheets of paper should be folded in this manner, one at a time. When all sheets are folded, each sheet should be placed inside the previous sheet beginning with the two blank sheets.

XI. Procedure (continued):

3. At this point the teacher should call each student to a specific area and assist in punching holes in the signatures for sewing. To do this, the teacher should hold the scratch awl in one hand and the book pages in the other. While the teacher positions the scratch awl, the student prepares to force it through the paper. Five holes should be punched 1½" (36mm) in from each end of the book, one in the middle of the book and one centered between each of the previous holes. All holes should be punched from the inside to the outside of the signature.



4. The student should pick up the needle and thread after punching the holes. Needle should be threaded and sewing begun at one end of the signature from the inside and continue in and out each of the five holes. Thread should not be taken around the outside of the signature. Pull the first stitch out toward the back of the signature, then tie the two loose ends together using a square knot. Each student should place her or his name on the signature and the teacher should collect all of them. The teacher should now distribute a piece of 12" x 18" white drawing paper.

5. The cover is made by placing the cover pattern on the piece of drawing paper and tracing around the outside and inside of the pattern. To do artwork on the cover, the side of the paper with the lines traced on it should be down. The lines should very lightly show through the paper. The left rectangle will become the front cover of the book. Artwork can be done with crayons or magic markers. This is the end of the first lesson.

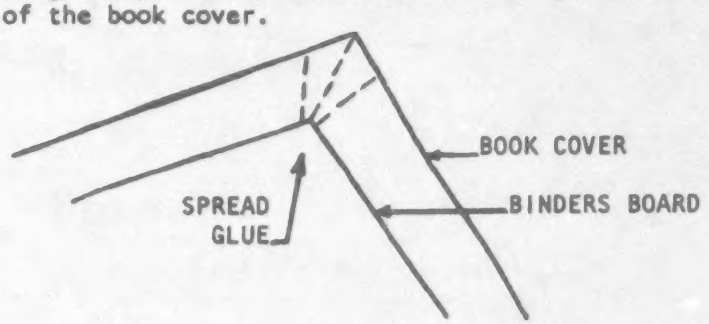
XI. Procedure (continued):

6. Before the next lesson, the teacher should cut the contact paper for the class and trim the outside edge of the signature to even the pages. The students should complete their art work. When all covers are completed, the teacher should attach the contact paper.

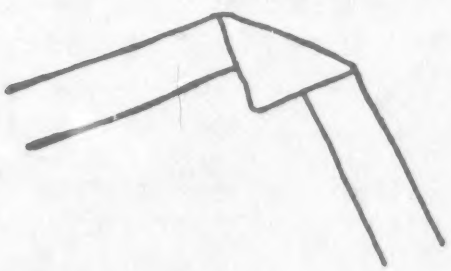
7. To begin the second lesson, the book covers with the contact paper attached should be distributed along with a piece of newspaper, a bottle of glue, gauze, a glue spreader and two 5 1/4" x 8 1/8" pieces of binders board.

8. Glue is spread evenly on one piece of binders board and then the board placed within the rectangle that was traced during the previous lesson. Do the same operation to the second piece of binders board.

9. Place a dot of glue on one outside corner of the binders board using the glue spreader. Be sure to spread glue out toward the corner of the book cover.

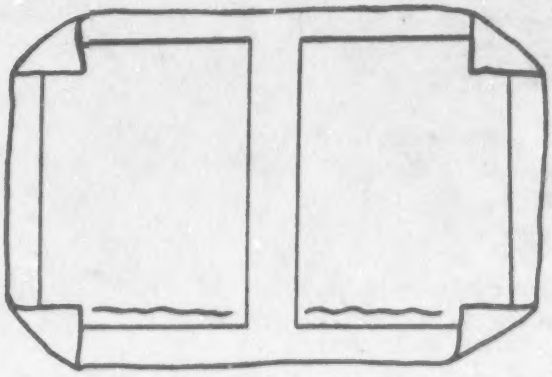


10. Carefully fold the corner of the book cover in toward the center of the binders board.



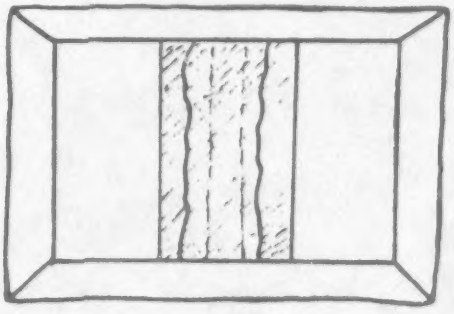
XI. Procedure (continued):

Repeat this operation for each of the other three corners. Carefully fold each edge of the book cover over the binders board. Apply a bead of glue on one edge of the binders board while spreading it toward the outside edge of the book cover. Press down firmly on the fold so that a tight neat edge is formed.



Repeat this operation with other three edges.

11. Apply a bead of glue to each edge of board near space in the center of the book and spread glue. Attach the piece of gauze.



12. Spread the glue on one side of the book cover staying about ¼" inside of the outside edges. Position back of signature so that it rests in the center of the space between the binders board. Press page down evenly and repeat operation on the second side. The books are finished.

13. The newspaper and glue spreaders should be discarded. The glue bottles can be cleaned and returned to storage.

XI. Procedure (continued):

14. As a final evaluation, have each student compare her or his book with a standard text to see the similarities.

XII. Final Suggestions by the Writer:

Creative writing should be checked by the teacher before it is entered into a book. Time can be saved if the teacher pre-cuts all clear contact paper and white drawing paper for covers. The teacher should also attach contact paper to the drawing paper. The junior high industrial arts teachers may be able to cut binders board for the elementary school teacher (DCH).

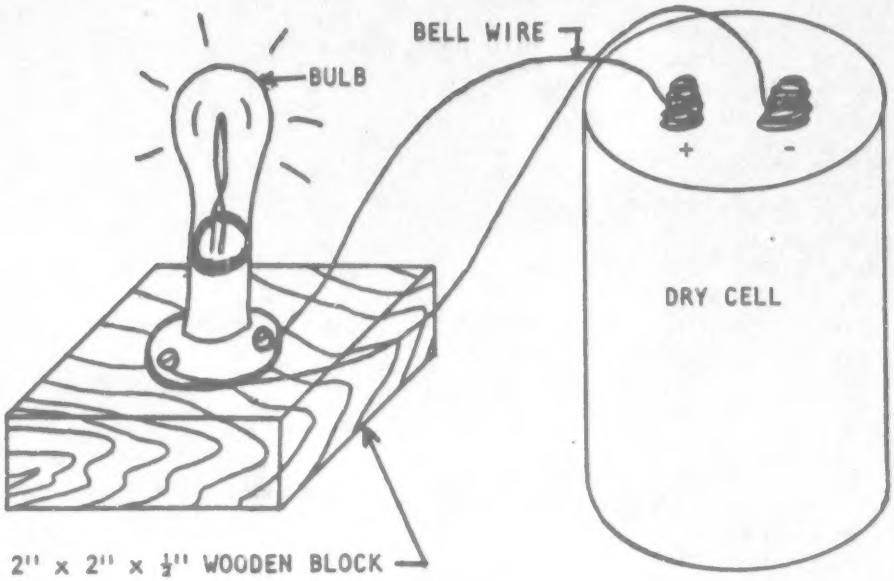
Sample Lesson Plan

I. Name of Activity: Learning About Electricity

II. Purpose of Activity:

An introduction to some of the properties of electricity to the primary-level student by the construction of a simple light circut.

III. Pictorial Drawing:



IV. Behavioral Objectives:

During this lesson, each primary student will:

1. Produce static electricity.
2. Construct a simple series circuit.
3. Use a screwdriver.
4. Bend wire.

V. Application and Acquisition of Skills:

Gross Motor Training

1. Sawing base to size

Fine Motor Training

1. Bending wire

Language Activities

1. Deciding
2. Listening
3. Reacting
4. Naming objects

Perceptual Activities

1. Identifying
2. Motor perception

Industrial Arts Activities

1. Discovery of materials
2. Manipulating tools
3. Respecting tools and materials
4. Constructing individually
5. Appreciating the world of work

Science Activities

1. Discovering
2. Experimenting
3. Observing
4. Questioning
5. Reporting
6. Comparing

VI. Tools and Equipment:

Screwdrivers, 6" in length
Needle-nose pliers
Coping saw (optional)
Portable vise
Goggles, for students who may be sawing

VII. Materials:

Balloon, one per student
Small piece of wool cloth, one for each student
Piece of soft wood, 1/2" x 2" x 2", one for each student
Bell wire, 16" per student
Bulb to fit miniature socket, one per student
Dry cell, large #9, one for several students
Piece of pine 3" x 3" (optional)

VIII. Safety Considerations:

1. Tell students about dangers of high voltage electricity and why we should understand and respect it.
2. Demonstrate and tell the students about safe use of all tools.
3. Demonstrate and explain how conductors and non-conductors can be used in controlling the flow of electricity.

IX. Career Awareness:

Discuss the need for such careers as electricians, electrical engineers, TV repairers, telephone company workers and power company workers. Ask the students to identify as many electrical workers as they can. Perhaps some of their parents work in the electrical industry.

X. Procedure:

1. Give each student a balloon and a piece of wool cloth.
2. Ask each class member to blow up the balloon then tie the end shut.
3. Ask the students to rub a wool cloth against the balloon, touch it to a wall while letting go of the balloon. Why does the balloon attach itself to the wall? Explain "static" electricity.
4. Issue to each student one miniature bulb and socket, a piece of soft wood 1/2" x 2" x 2", two pieces of bell wire about 8" long with ends stripped and two round head #6 brass screws,1/2" long. The students can share in the use of the #9 dry cells (in small groups of two or three).
5. Demonstrate how to fasten the bulb socket to wood using two brass screws. Have pilot holes pre-drilled in the wood. Fasten two pieces of 8" bell wire to bulb socket, then touch the wire to posts on dry cell battery and demonstrate how completing the circuit causes the bulb to light. Now have the students construct their own lighting circuit as demonstrated by the teacher.

XI. Final Suggestions by the Writer:

It is suggested that the wood be pre-cut and pilot holes for wood screws be pre-drilled for these primary-level students. A guest speaker from the telephone or electric company would enhance this unit, while helping the students to become aware of careers in this area of our society (NEL).

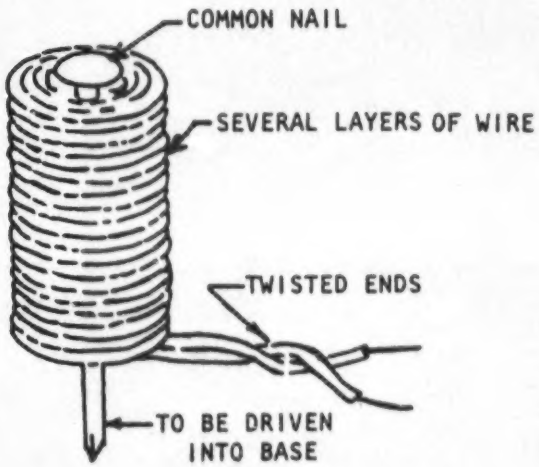
Sample Lesson Plan

I. Name of Activity: Electromagnets and Telegraphs

II. Purpose of Activity:

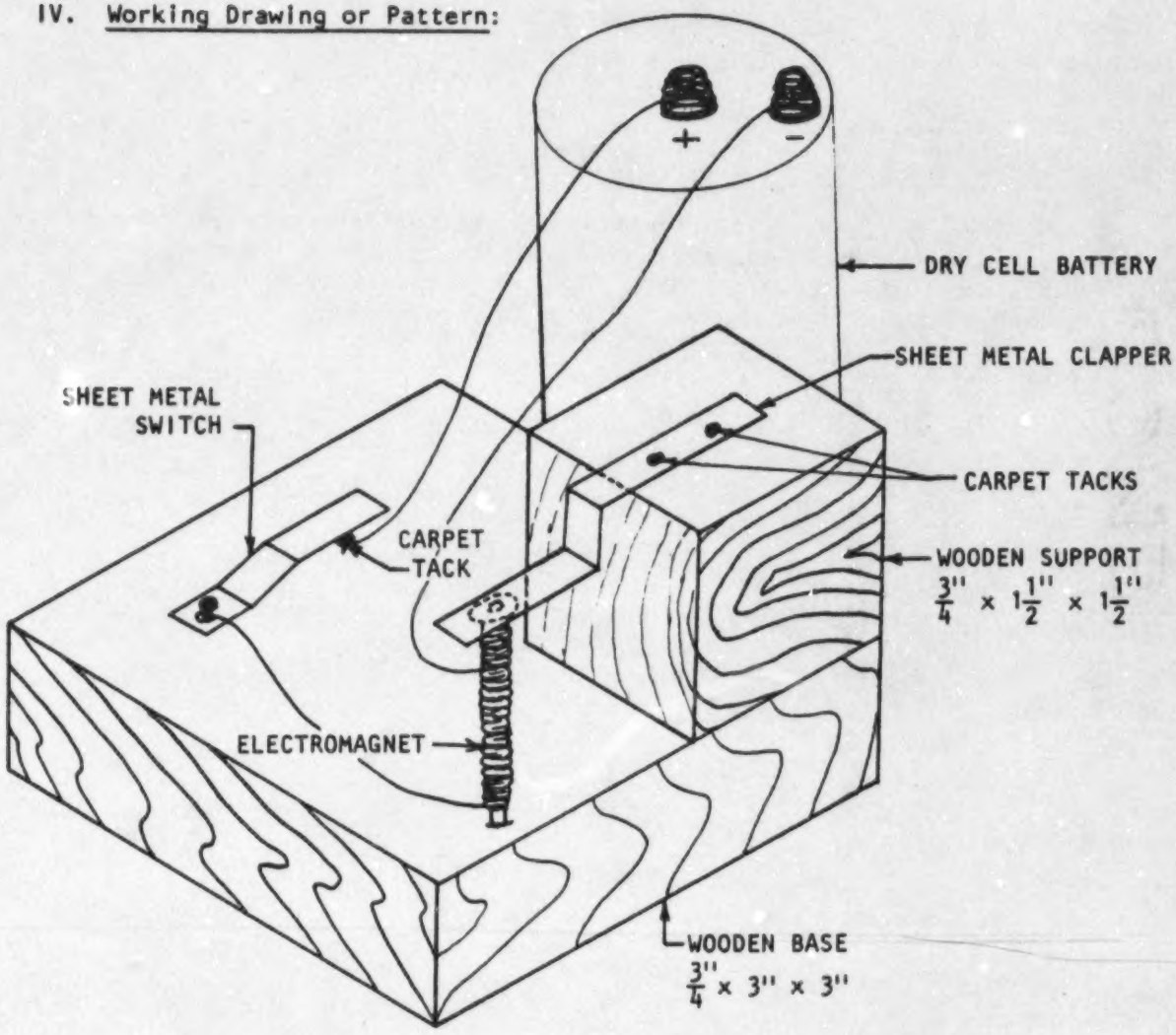
Elementary students will be able to explore the relationships between electricity, magnets and the communications industry. Science, measurement and communication skills can be easily related to these classroom activities.

III. Pictorial Drawing:



ELECTROMAGNET FOR USE ON THE TELEGRAPH

IV. Working Drawing or Pattern:



TELEGRAPH

V. Behavioral Objectives:

These elementary students will be able to:

1. Describe the function of electromagnets and their use in telegraphs.
2. Construct a working telegraph.
3. Relate the importance of the telegraph to the development of communications throughout the nation.
4. Discuss the relationship between electricity and magnetism.
5. Assist with clean-up activities and organizational procedures such as distributing tools and materials.
6. Share tools and assist others in the construction activities.

VI. Application and Acquisition of Skills:

Language Activities

1. Reading, writing and discussion skills may be developed through research and reporting activities concerning the telegraph and its impact on society.
2. Spelling might be encouraged by sending morse code messages through the student-constructed telegraphs.

Science Activities

1. Experimentation skills may be developed (for example, students can experiment by increasing or decreasing the wraps of wire around the nail).
2. Observation and inquiry skills may be developed by noting and questioning the effects on the magnet's power.
3. Reporting skills may be developed (for example, students could report these findings in chart form).

Social Studies Education

1. Discuss the completed construction of a telegraph line between Washington, D.C. and Baltimore in May, 1844 marking the beginning of a communications revolution.
2. Discuss how prior to the telegraph line, people received news weeks and sometimes months after the event.
3. A study of the telegraph, its American inventor, Samuel Morse, and its effects on American culture could provide many interesting and enlightening discussions to the elementary classroom.
4. Compare the social changes accompanying the telegraph to the social changes accompanying the telephone and television.

Industrial Arts Activities

1. Constructing individually or cooperatively.
2. Discovering materials.
3. Discovering power activities.
4. Improving gross and fine motor skills.
5. Manipulating tools.
6. Respecting tools and materials.

VII. Tools and Equipment:

Square-nose pliers with wire cutters
Scratch awls
Tin snips
Panel saws
Claw hammer, 7 or 13oz.
One 6-volt dry cell battery, #9

VIII. Materials:

Magnet wire
120 grit abrasive paper
12" rulers
Pencils
Large carpet tacks
Common nails, 8d
Galvanized sheet metal (20 gauge), one piece 1/2" x 1" and one piece 1/2" x 2"
Wooden base, 3/4" x 3" x 3"
Finish nails, 1 1/4" long

IX. Safety Considerations:

1. Students should wear goggles while performing construction activities.
2. Students should be cautioned to use extreme care when:
   a. working with sheet metal in that it has sharp edges and
   b. holding nails while using the hammer.
3. The teacher should punch or pre-drill the sheet metal to facilitate the students' fastening activities.

X. Career Awareness:

The teacher should lead a class discussion on the careers associated with the use of the telegraph, such as: the key operator, the repairperson or the "singing" messenger. This activity could be expanded to all communications-related employment including television, radio and telephones. In addition, the teacher could assign individual research and writing reports in this area for intermediate-level children.

XI. Procedure:

First, make the Electromagnet (see drawing).

1. Using magnet wire, measure and cut off 9 feet of wire.
2. Secure a 8d common nail and begin to wrap the wire tightly around it. (Note: leave 1 1/2 feet of wire before wrapping begins.)
3. Wind the wire around the nail while overlapping.
4. Leave 1 1/2 feet of wire free at the end of the last winding.
5. Strip the coating off both ends of the wire about 1 1/2 inches.
6. Connect each stripped wire to a post on a battery. Test the electromagnet by trying to pick up a paper clip.

Then, assemble the Telegraph (see drawing).

7. The teacher should cut the wooden blocks to size.
8. Sand the wooden blocks to make them smooth.
9. Cut the metal strips as indicated, use tin snips.
10. The teacher should mark the metal strips, puncture with a nail and hammer.
11. Align and attach (with glue and nails) the support block to the base.
12. Nail the electromagnet into the base.
13. Attach the clapper to the support block.
14. Attach one wire from the electromagnet to the base of the switch (tack).
15. Attach other end of the electromagnet to one post of the battery.

XI. Procedure (continued):

16. Attach a wire from the top part of the switch assembly to the other post .
17. Test the telegraph by touching the switch to the tack terminal.
    Note: If the electromagnet does not operate the telegraph try to:
    a. be sure all wires where contact is made are stripped.
    b. adjust the clapper so that it is about 1/8" above the magnet.

XII. Final Suggestions by the Writer:

This activity provides much enthusiasm for communications through the telegraph. Remind the students that if their telegraph stops working with continued use, it can usually be fixed by adjusting the clapper or cleaning the contact points (DGM).

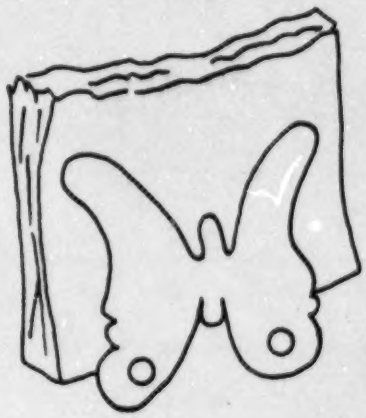
Sample Lesson Plan

I. Name of Activity: Teaching Proportions Through Enlarging and Reducing

II. Purpose of Activity:

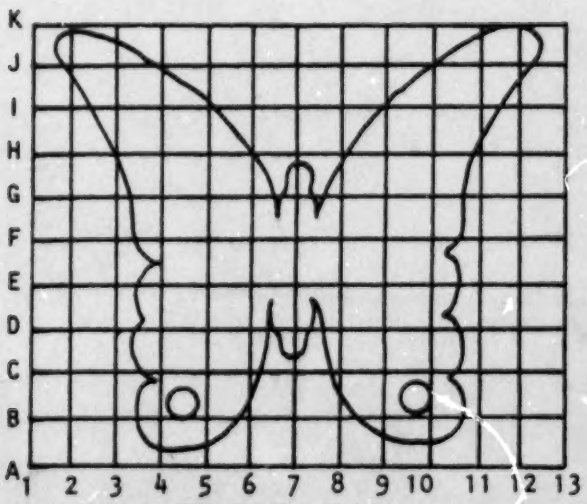
Intermediate-level children will enjoy enlarging or reducing their favorite objects or drawings. Self-confidence is enhanced when they realize that they can make a drawing to scale and proportion prior to its use when constructing a project.

III. Pictorial Drawing or Photograph:



NAPKIN HOLDER

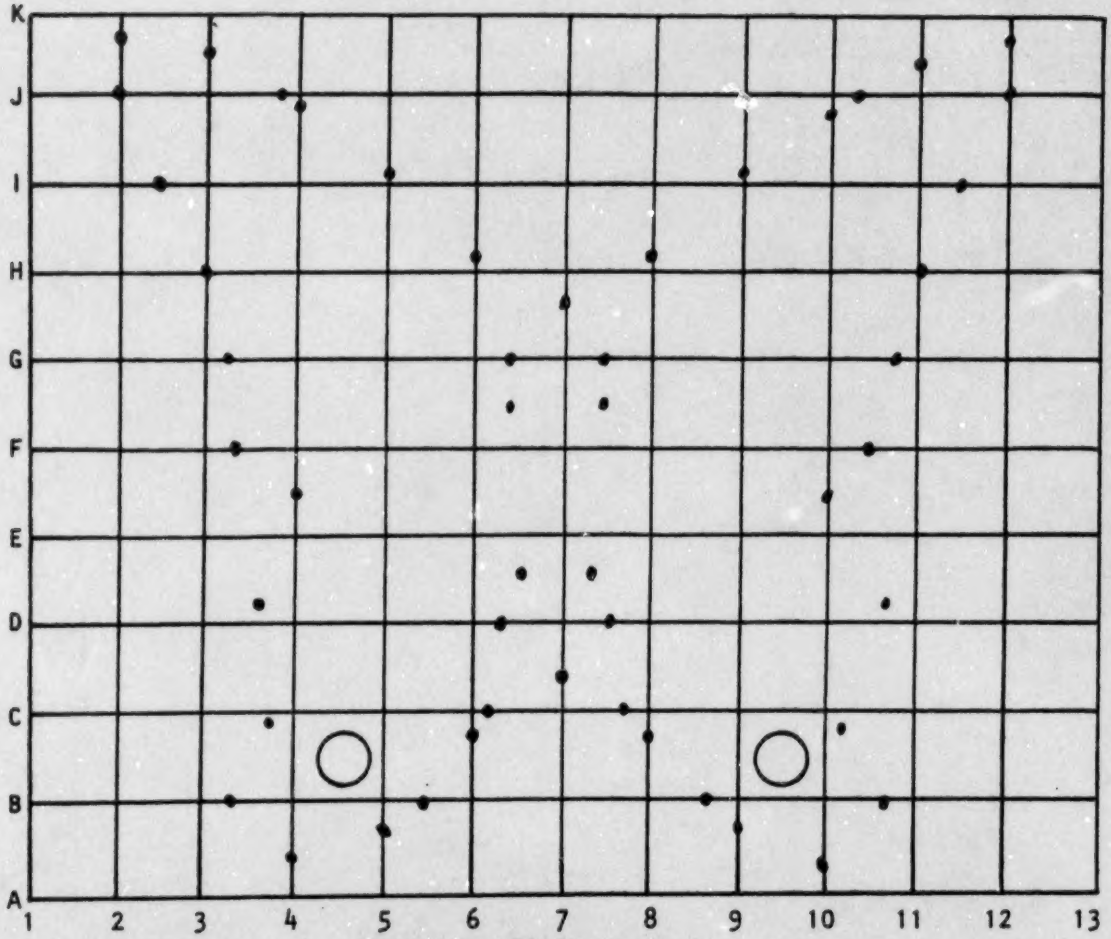
IV. Working Drawing or Pattern:



ORIGINAL DESIGN

GRID: ¼" SQUARES

IV. Working Drawing or Pattern (continued):



ENLARGED DESIGN

GRID: ½" SQUARES

NOTE: THIS PROCESS IS EITHER ENLARGING OR REDUCING BY GRAPHS OR GRIDS.

V. Behavioral Objectives:

During this lesson, each intermediate-level student will:

1. Discuss the concepts of reduction and enlargement.
2. Describe several uses of this process at school and within the outside world.
3. Select and sketch an original design.
4. Compute the ratio needed to enlarge her or his design to fit an area 6" by 7".

V. Behavioral Objectives (continued):

5. Enlarge her or his design to the above dimensions using the grid method as demonstrated.
6. Act in the selection process of choosing the best design for use by all members of the class.
7. Construct one napkin holder using the selected design and the processes demonstrated by the instructor.
8. Act as a member of the class during each working and clean-up session.

VI. Application and Acquisition of Skills:

Gross Motor Training

1. Hammering
2. Sawing

Fine Motor Training

1. Cutting
2. Drawing
3. Writing

Perceptual Activities

1. Associating
2. Classifying
3. Comparing
4. Noting relationships
5. Organizing
6. Reproducing
7. Sequencing
8. Space orientation

Mathematical Activities

1. Counting
2. Form
3. Mathematical vocabulary
4. Mental computation
5. Number
6. Numerals
7. Relationships
8. Size
9. Shape
10. Use of mathematics in everyday life

Industrial Arts Activities

1. Constructing individually or cooperatively
2. Discovering materials
3. Manipulating tools
4. Respecting tools and materials

VII. Tools and Equipment:

Pencils
Rulers
Half-round or flat files, 10" long, rough cut, with handles
Abrasive paper, 80 grit
Abrasive paper, 120 grit
Clamps, c-type or small portable vises
Coping saws, with extra blades
Claw hammers, 7 or 13 oz.
Goggles
Saw horses or work benches, approximately 28" in height
Paint brushes, assorted sizes, small
Hand drills
Twist drills, $\frac{1}{4}$" diameter

VIII. Materials:

Wooden stock, 1/2" x 6" x 7", two pieces for each student, or
Plexiglas, 1/8" x 6" x 7" (optional), two pieces for each student.
Graph paper, 8½" x 11", ¼" grid.
White paper, 8½" x 11", (no grid).
Dowel rods, ¼" diameter, 3" piece for each student.
White polyvinyl glue.
Wire nails, #18 x 3/4" long, one small box.
Latex paint.
Water-base stain and clear finish, as desired.

IX. Safety Considerations:

1. Students should be reminded to work carefully when sawing, hammering and filing.
2. Students must wear goggles when hammering, sawing, filing and sanding as required by state law.
3. Be sure to use finishing materials in a well-ventilated area.
4. Store all finishing materials in metal containers within metal cabinets.

X. Career Awareness:

Career awareness can be increased through a class discussion on persons who use mathimatics each day for determining proportion. Several examples might include photographers, commercial artists and set designers for stage plays. Reading assignments, class reports and 16mm educational films can further expand the students' knowledge of the practical uses of enlarging and/or reducing.

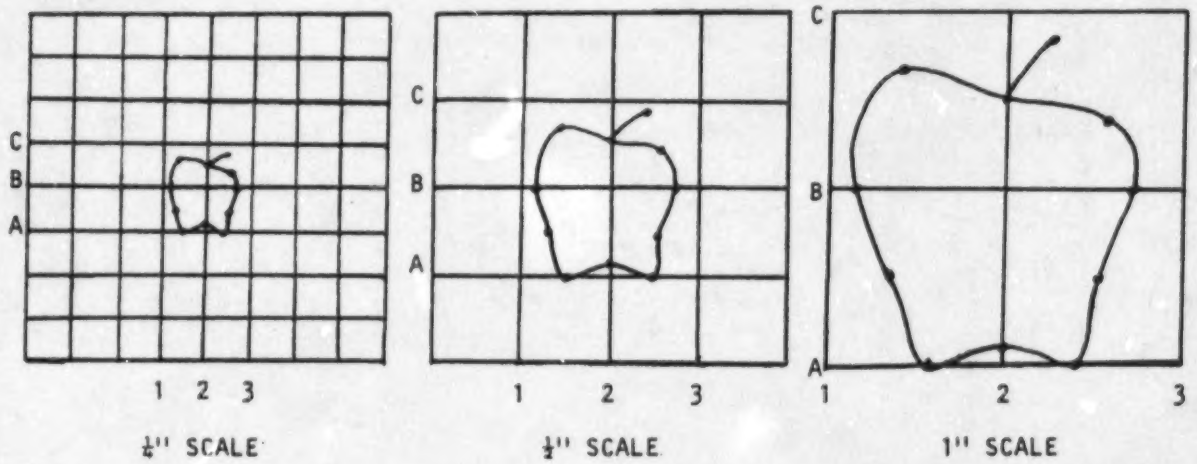
XI. Procedure:

1. Making the drawing.

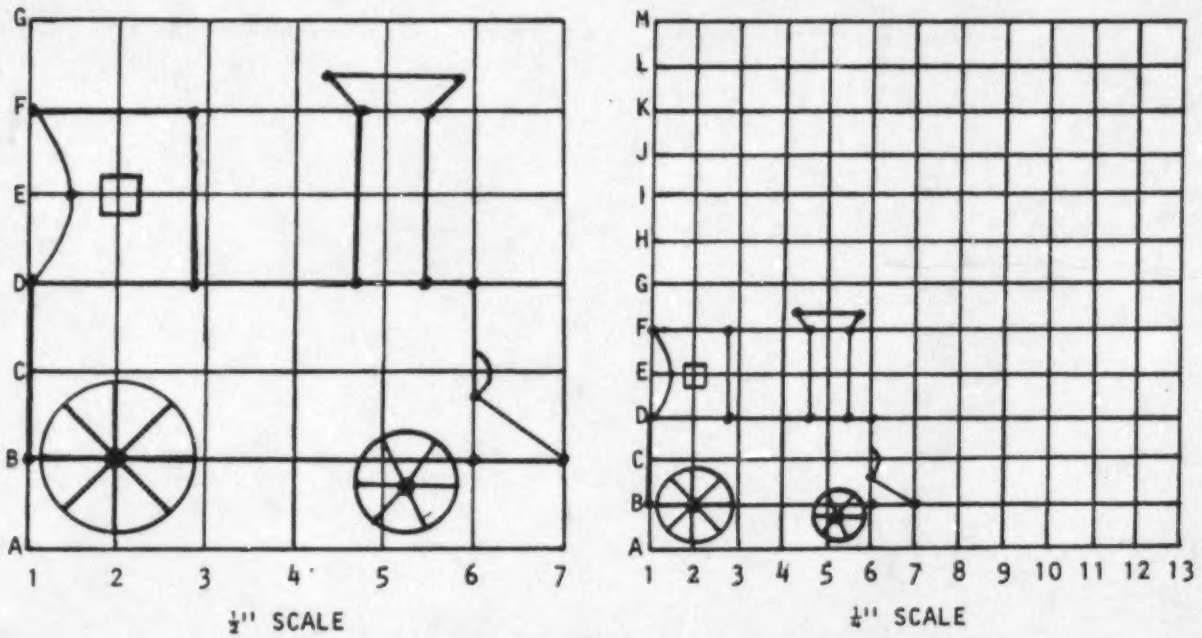
   A. Lead a class discussion on the uses of enlarging or reducing through the use of graphs or grids.
   B. Discuss and demonstrate the process of reducing or enlarging by:
      1. Selecting the design to be used.
      2. Drawing vertical and horizontal lines at either 1", ½" or ¼" apart. This will depend upon if the drawing is to be reduced or enlarged as well as the amount of change needed in size.
      3. Label the horizontal lines with numbers and the vertical lines with letters.
      4. Place dots at the desired intervals.
      5. Connect the dots to complete the design's new proportions. This will be a full-size pattern.

XI. Procedure (continued):

C. Demonstrate the process by using this example for enlarging a sketch of an apple.



D. Demonstrate the same process when reducing in size this railroad engine.



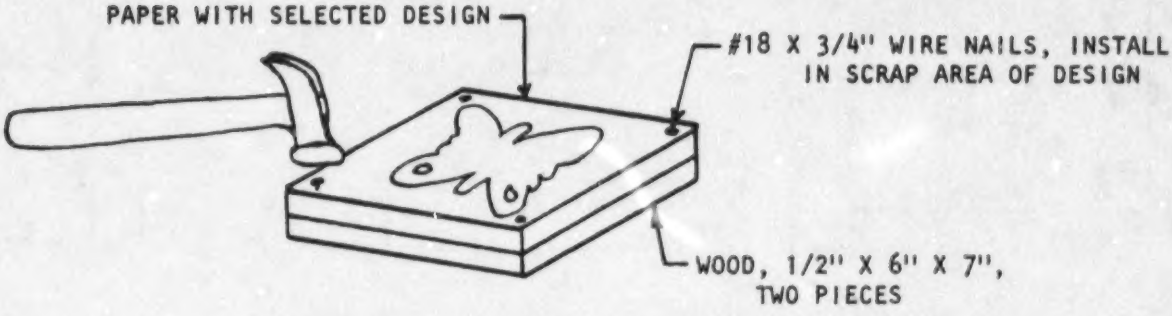
E. Have each student present her or his design to the class for possible use.

F. Have the class as a whole, select the design for the sides of the napkin holder.

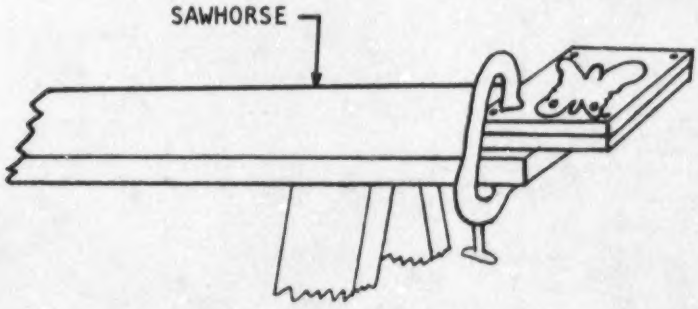
XI. Procedure (continued):

2. Making the napkin holder.

A. Give each student a full size pattern of the selected design.
B. With four wire nails (one in each corner) attach the two pieces of wood and the selected design together while using a claw hammer.



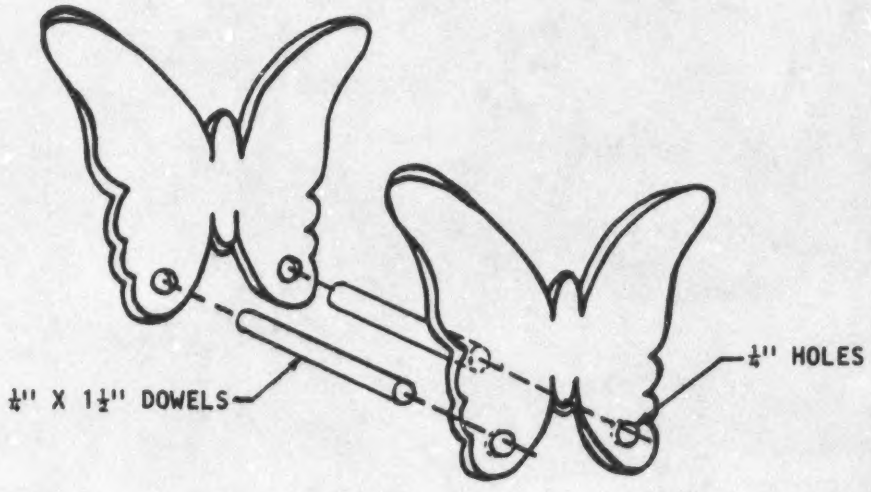
C. Using a hand drill and 1/4" diameter bit, drill two holes in the wooden stock near the bottom of the napkin holder. The positions are optional, but should be the same distance from the bottom edge of the design while being at least 1/2" from all edges.
D. Using a c-clamp and sawhorse, prepare to saw out the above "sandwich" of wood and paper. Portable wood vises also can be used, if available.



E. While wearing goggles, cut out the design with a coping saw.
F. Shape all edges of the wood with a rough cut file. Be sure to file both pieces of stock at the same time while being held in a vise or c-clamp.
G. Using abrasive paper, smooth all edges and surfaces.

XI. Procedure (continued):

H. Assemble the parts of the napkin holder as indicated below. Use white polyvinyl glue and a hammer to install the ¼" dowel rods.



I. Apply latex paint or clear finish as desired.

XII. Final Suggestions by the Writer:

The teacher can select one design for the entire class or have each student determine her or his own idea. This can often be determined by the amount of time that is available for working on this activity. Plastic sheet such as clear or colored plexiglass can be substituted for the wooden sides (MCC).

Lesson Plan Form
(for duplication)

I. Name of Activity:

II. Purpose of Activity:

III. Pictorial Drawing or Photograph:

IV. Working Drawing or Pattern:

V. Behavioral Objectives:

VI. Application and Acquisition of Skills:

111

VII. Tools and Equipment:

VIII. Materials:

IX. Safety Considerations:

X. Career Awareness:

XI. **Procedure:**

Resource List

The following books and materials contain a variety of hands-on activities and information that can help girls and boys develop an appreciation for the elementary school curriculum through industrial arts activities.

American Men and Women of Science, R. R. Bowker, Co., 1979; and Modern Scientists and Engineers, McGraw-Hill Book Co., 1980.
Both references offer biographical sketches of women and men who have contributed to the growth of American technology. Suggested for older readers.

Bell, Corydon and Thelma Harrington Bell. The Riddle of Time. The Viking Press, Inc., 1963.
Explains how time was measured throughout history, how time is used in biology and geology, and how ideas about time have changed. Suggested for older readers. Includes illustrations.

Bendick, Jeanne. All Around You: A First Look at the World. McGraw-Hill Book Company, 1960.
A picture book that answers many of the basic questions about nature. Suggested for young readers.

Bendick, Jeanne. Electronics for Young People. McGraw-Hill Book Company, 1960.
A survey of electronics, including a discussion of automation, computers, nuclear energy and radio telescopes. Includes illustrations. Suggested for intermediate readers.

Bendick, Jeanne and Robert. Television Works Like This. McGraw-Hill Book Company, 1965.
How television programs originate, how TV signals reach a television set and how the signals are converted into pictures. Illustrations included. Suggested for intermediate readers.

Books: An Annotated Bibliography. The American Council for Elementary School Industrial Arts (American Industrial Arts Association, 1914 Association Drive, Reston, Virginia 22091), 1971.
An excellent reference for seeking books to assist with ESIA activities. References are grouped under headings such as industry, light, leathercraft, paper, photography, transportation, heat and many others.

Branley, Franklyn M. High Sounds, Low Sounds. Crowell, 1967.
The questions of how sounds are created and how they reach one's ears are fully described and illustrated. Simple experiments for classroom use are included. Suggested for young readers.

Burnett, R. Will. Teaching Science in the Elementary School. Rinehart and Company, Inc., 1957.

Calder, Clarence R. and Eleanor M. Antan. Techniques and Activities to Stimulate Verbal Learning. MacMillan Publishing Company, 1970.
An excellent reference for understanding the theory of the use of hands-on activities in the elementary school classroom. The authors have described many activities which teachers can use to stimulate verbal learning. Most activities are illustrated.

Cannon, Robert. Estes Educator News. Education Department, Estes Industries (Department 206, Penrose, Colorado 81240).
Published periodically, the Estes Educator News contains many articles of interest on model rocketry. It is also a source of free and inexpensive teaching aids and other valuable information to teachers using model rocketry as an exciting means of learning.

Children's Playcraft. Parents' Magazine Enterprises, Inc. (80 New Bridge Road, Bergenfield, NJ 70621).
A monthly plan publication containing many activities which can be easily adapted to the elementary school industrial arts program. In many instances, this magazine brings everyday items around the home into the child's world of play and learning. The illustrations are easy to understand and can be used by teachers and parents. An excellent source of ideas.

Clarke, Donald, Editor. The Encyclopedia of How It's Built. A and W Publications, 1976. Also available: How It's Made and How It Works.
These books provide a rich explanation of our technical world. The graphic representations and cut-away views of various machines are helpful in understanding how it is made and how it works.

Comins, Jeremy. Totems, Decoys and Covered Wagons: Cardboard Constructions from Early American Life. Lothrop, 1976.
This book contains directions for making large-scale, cardboard replicas of objects representative of American Indian and colonial life such as houses, furniture, toys and other artifacts.

Cook, Anne H. and Jane T. Breinfolt, Editors. Project 1776, A Manual for the Bicentennial. Bicentennial Commission of Pennsylvania (Project 1776, 451 School House Lane, Devon, Pennsylvania 19333), 1975.
Although the bicentennial is past, the study of colonial history is part of every child's education. This book is a tremendous source of information on how things were made and used by colonial Americans. Includes plans for things to make, games, songs, recipes, excellent bibliographies, film lists and other resources.

D'Amato, Janet and Alex. Colonial Crafts for You to Make. Simon and Shuster, Inc., 1975.

Dobbs, Ella Victoria. Primary Handwork. The MacMillan Company, 1914.

Dreves, Fred J., Director. Getting Started in the Classroom (Vocational-Technical Curriculum Laboratory, Building 4103, Kilmer Campus, Rutgers-The State University, New Brunswick, New Brunswick, New Jersey 03903), 1973. Developed by the Technology for Children Project, this publication helps teachers develop an interest-learning center where students can explore the technical world. Suggested areas include aviation, construction, ecology, foods product testing, sound, tool testing and printing, to mention a few. Includes a basic understanding of problem-solving and safety practices for classroom use. Publication can also be useful for inservicing elementary teachers.

Esler, William K. Teaching Elementary Science. Wadsworth Publishing Company, Inc., 1973.
A methods text for instructing the classroom teacher on progressive approaches in the K-6 program. This effort is well organized and easy to follow. The activities are described and illustrated in a manner that is believable for the instructor and the student as well. The author goes to great lengths to identify "concepts" and "sub-concepts" in each area of scientific investigation.

Feravolo, Rocco V. Easy Physics Projects: Air, Water and Heat. Prentice-Hall, Inc., 1966.
This text and the next one contain descriptions and illustrations of physics experiments with an explanation of the scientific concepts involved. Both references are recommended for the intermediate reader.

Feravolo, Rocco V. More Easy Physics Projects: Magnetism, Electricity and Sound. Prentice-Hall Inc., 1968.

Fisher, Leonard Everett. The Homemakers. Watts, 1973.
Describes how candles, soap, brooms and cider were made in colonial times.

Garnett, Hugh. Musical Instruments You Can Make. Pitman Publishing, London, 1976.

Geil, John. A New Point of View. Stanley Tools Education Department (New Britain, Connecticut 06050).
A useful guide to beginning tool activity in ESIA and career education. This booklet describes the values elementary children can derive from early introduction to working with tools and wood. A practical approach to getting started with industrial arts in grades K-6.

Gilbert, Harold G. Children Study American Industry. William C. Brown Company, 1966.
A basic textbook which takes a look at the development of industry through a study of manufacturing, construction, communications, transportation and power. In each of these areas, activities are suggested and illustrated.

Hopwood, Robert. Science Model Making. MacMillan Company, New York, 1963.

How and Why Wonder Book(s). Grosset and Dunlap, New York, 1972.
These numerous books provide activities and simple explanations concerning electricity, machines, sound, rockets, magnets and basic inventions. Books are written in a clear style, supplemented with many illustrations. Teachers could glean industrial arts lessons directly from these references.

Introducing the World of Work. National Schools Committee for Economic Education, Inc. (143 Sound Beach Avenue, Old Greenwich, Connecticut 06870), 1977.
A manual to convey to pupils the basic economic principles underlying the world of work. Primary concepts include social and economic developments, use of leisure time, multicultural awareness and global interdependencies. Includes suggested activities by grade level for the elementary classroom.

Johnson, June. 838 Ways to Amuse a Child. Gramercy Publishing Company, 1959.
This book was written by someone with a great deal of experience in working with young students. It is well organized and has many illustrations to assist the reader. Quite a few of the 838 ways would correlate with industrial arts in grades K-6. The author heavily reinforces the idea that children learn while playing.

Joseph, Joan. Folk Toys Around the World and How to Make Them. Parents' Magazine Press, 1972.
Introduces eighteen toys from various countries, gives directions for constructing them, and discusses materials needed.

Lasson, Robert. If I Had A Hammer. Dutton, 1974.
Introduces seven hand tools. Gives instructions for six woodworking projects that can be constructed by using the seven hand tools.

Leavitt, Jerome E. Carpentry for Children. Sterling, 1959.
Explains and portrays tools and their uses. Includes instructions for fifteen easy-to-make projects such as a sailboat, bird feeder, toy sled, book rack, candlesticks, cart and flower box.

Liebers, Arthur. Fifty Favorite Hobbies. Hawthorn, 1968.
Describes and illustrates hobbies appropriate for young people who are interested in science, pets, handicrafts and collecting. Suggested for intermediate readers.

Lowery, Lawrence F. The Everyday Science Sourcebook. Allyn and Bacon, 1978.
Contains many ideas for the selection of activities in teaching science at the elementary and middle-school levels. Most activities are fully illustrated for the teacher and the student as well. Author stresses the cognitive aspects of scientific problem solving through the use of "generalizations" and "contributing ideas." Since technology or industrial arts is the application of scientific principles, this is a must for every ESIA program.

Maginley, C.J. Historic Models of Early America. Harcourt, 1947.
Instructions for making models of plows, spinning wheels, log cabins, flatboats, mills, cradles and numerous other relevant items. Introduces each object with an explanation of its historical context.

Malis, Gene and Jofy. Boy Scouts of America Workshop Book. A Berkley Medallion Book, Berkley Publishing Corporation, 1973.
A pocket-size book written for Cub Scouts (ages 8-10), but full of ideas and information of interest to all boys and girls. Includes an illustrated section on tools and their uses, a discussion on how to select woods, glue and fasteners, and a discussion of general safety. More than half the text contains plans for making toys, games, play equipment, pet feeders and dozen of things of interest to children.

McPherson, William H., Editor. Industrial Arts - Career Education into the Elementary Curriculum. (Department of Public Instruction, Information and Publications, Grimes State Office Building, Des Moines, Iowa 50319), 1981.
A must resource for the classroom teacher who is either using or about to use ESIA activities to reinforce other subject matter. Contains 95 fully-described activities which are identified by academic areas, and units on safety, background information, tools and materials and additional resources needed for conducting a program. Available at a minimal cost.

Miller, Mabel E. Kindergarten Teacher's Activities Desk Book. Parker Publishing Company, Inc., 1974.
An excellent text to help identify games and activities for reinforcing primary-level education. Author has organized the activities around well-known areas in the curriculum such as language (word sounds) and mathematics (number skills). Industrial arts activities can play a major role in these efforts.

Morris, Floyd. 198 Easy Wood Projects. Goodheart-Wilcox, 1970.
Includes both full-size project patterns and squared patterns that can be enlarged for use in making items out of wood.

Muncy, Patricia T. Illustrated K-3 Alphabet Games and Activities. The Center for Applied Research in Education, Inc., 1980.
Several hundred games and activities for use in teaching language skills at the primary-level are identified. Each suggestion is fully described by purpose, materials, preparation, procedure and "what to say." An excellent source of good ideas when correlating industrial, fine and language arts.

Nelson, Glenn. Ceramics: A Potter's Handbook. University of Minnesota, 1966.
A basic reference for the many ceramic processes.

Neumann, Bill. Model Car Building. Putnam, 1971.
A discussion of the tools, materials and techniques needed to make model cars. Suggested for intermediate readers.

Palmer, Bruce. Making Children's Furniture and Play Structures. Workman Publishing Company, 1974.
An excellent source book of projects that can be made with corrugated cardboard, dowels and other simple materials. Children love to construct large objects that they can crawl into or climb on. Projects include domes, mazes, furniture, airplane, submarine and bus, to mention a few. The author also lists suppliers of special materials (for example: triple-thick cardboard), and tools.

Publications of the Thomas Alva Edison Foundation (2000 Second Avenue, Detroit, Michigan 48226).
Includes a series of booklets published during the 1960's and 1970's which show children how to make interesting projects and how to conduct experiments. Helps children understand how many everyday devices use energy. The titles are:

Edison Inventions and Related Projects (1968)
How to Build Five Useful Electrical Devices (1967)
Electrical Experiments You Can Do From the Diary of Michael Faraday (1961)
Nuclear Experiments You Can Do....from Edison (1976)
Environmental Experiments....from Edison (1973)
Edison Experiments (1969)
Selected Experiments and Projects....from Edison (1976)
Energy Conservation Experiments You Can Do....from Edison (1974)
Electrial and Chemical Experiments....from Edison (1970)

Scobey, Mary-Margaret. Teaching Children About Technology. McKnight Publishing Company, 1968.
Areas of concern include a description of technology and the elementary curriculum, major industries of America, and classroom experiences. Many processes are fully explained with illustrated activities for immediate adoption.

Shull, Jim. The Hole Thing: A Manual of Pinhole Fotography. Morgan and Morgan, Inc. (145 Palisade Street, Dobbs Ferry, New York 10522), 1974.
A well-illustrated and simple approach to photography for children. Explains the theory of pinhole photography, how to construct and use a pinhole camera and develop the pictures. In addition, this text provides a sound foundation for getting started in photography. Some teachers may object to the author's occasional use of phonetic spelling (for example: fotography, lite).

Sibley, Hi. 102 Bird Houses, Feeders You Can Make. Goodheart-Willcox, 1967.
Contains numerous plans for simple and complex bird houses and feeders.

Sloane, Eric. ABE Book of Early Americana: A Sketchbook of Antiques and American Firsts. Doubleday, 1963.
The author-artist describes his book as an alphabet book, but it can also be used as an encyclopedia of early Americana.

Smithsonian Book of Invention. Smithsonian Exposition Books, W. W. Norton and Company, 1978.
A well-written history of technological progress, this book offers a broad perspective on industry and technology. The stories and chronological sequence of inventions can help the teacher relate industrial arts to history and social change.

Swierkos, Marion L. and Catherine G. Morse. Industrial Arts for the Elementary Classroom. Charles A. Bennett Company, 1973.
Stresses the use of integrating handwork in the elementary school program. Instructional areas include planning, designing, ceramics, basketry, leather, textiles, woodworking and plastics to mention a few.

Tunis, Edwin. Colonial Craftsmen and the Beginnings of American Industry. World, 1965.
Describes the methods, products, tools and shops of the colonial craft workers. Some examples of this group include blacksmiths, joiners, wigmakers, eyeglass sellers, silversmiths and bookbinders.

Tunis, Edwin. Colonial Living. World, 1957.
This reference describes houses, furniture, crafts, clothes, tools and crops of the colonial period. Includes descriptions of the skills and crafts that were practiced to produce the above projects, and many excellent pen-and-ink drawings.

Victor, Edward. Science for the Elementary School. The MacMillan Company/ Collier-MacMillan Limited, London, 1971.
A basic text for assisting the classroom instructor on teaching elementary school science. The first portion of this book discusses methods on "how" to teach. The second phase deals with content or "what" to teach, and covers such topics as the earth and the universe, living things, matter and energy. Many illustrations are included with activities that permit students to explore and find science in their ever-expanding world. Many opportunities are presented to correlate with industrial arts.

Wankelman, Willard F. and others. A Handbook of Arts and Crafts. William C. Brown Company, 1974.
While all sections may not be of equal importance and use, the sections on ceramics, crafts, paper and cardboard, printing processes and textiles are excellent for planning industrial arts in grades K-6. All ideas and methods are well illustrated.

Weiss, Harvey. Motors and Engines and How They Work. Crowell, 1969.
Contains discussions of many types of motors and engines, and the mechanical principles by which each operates; water wheels, windmills, steam engines, solar engines and rocket engines. Includes instructions on how to build model motors and engines. Suggested for intermediate readers.

Zarchy, Harry. Ceramics. Knopf, 1954.
A basic comprehensive guide with drawings and photographs showing the reader each step in the ceramic process.

Audiovisual Aids Available

The following audiovisual aids can be shown to either children or to teachers and parents. They are useful in explaining sex-role stereotypes viewers may have of what boys and girls are expected to do or not to do. Contact the Vocational Education Equity Program, Pennsylvania Department of Education, 333 Market Street, P.O. Box 911, Harrisburg, PA 17108, to borrow these items at no charge.

CHANGING IMAGES (16 mm film, black and white) University of California, Extension Media Center, Berkeley, CA 94720

Elementary students learn about their own stereotyped ideas of sex roles and occupations. Through several weeks of learning about sex role occupational stereotyping, they come to realize that boys and girls can be anything they want to be. An excellent film to motivate students of all ages and to inspire teachers and parents.

TIME HAS COME (16 mm film, color) Third Eye Films, 12 Arrow Street, Cambridge, MA 02138

This film is intended for parents, but it can be used at child care programs, community programs, workshops on sexism and stereotyping, and early education inservice program. It informs the audience that awareness, common sense and acknowledgement of past practices of sex stereotyping are the first steps toward non-sexist parenting. When stereotyping is eliminated, children's horizons are opened. To be effective, this film should follow activities that introduce audience to damaging results of sexist child rearing. Leader's guide and parents' handout are included.

FABLE OF HE AND SHE (16 mm film, color, 11 minutes) Learning Corporation of America, Distribution Center, 4600 West Diversey, Chicago, IL 60639

Animated fable gently challenges stereotyped and sexist ideas. Strong hardybars hunt for food and shelter while mushamels cook and take care of the little ones. When a disaster forces a split between hardybars and mushamels, they learn to accept new roles. When they come together, they begin to work out new ways of cooperation rather than limiting their roles on the basis of being a mushamel or hardybar. Appropriate for all audiences.

CHILD CARE SHAPES THE FUTURE: ANTI SEXIST STRATEGIES (Filmstrip, 20 minutes) Council on Interracial Books for Children, 1841 Broadway, New York, NY 10023

Society's expectations about how pre-school children "should" behave are examined. Part I shows how rearing boys to fulfill traditional masculine roles and rearing girls to fulfill traditional feminine roles can lead to harmful results. Part II presents ten specific strategies for adults who want to help children identify and counteract sexism. Can be shown to parents, early childhood educators, play group and elementary school personnel, or vocational students enrolled in child care courses.

FREESTYLE, Los Angeles County Superintendent of Schools, 1979.

This television series--13 dramatic half-hour stories--tells girls and boys, age nine to 12, how they can discover new activities, new career-related interests, and new behaviors when they understand how sex-role stereotypes limit their lifestyles. Each program conveys one major idea. For example, the third program concentrates on nontraditional skills and interests, and the sixth program concentrates on the changing roles of men and women.

To obtain the series, send thirteen 30-minute videocassettes to the Electronic Media Center at the PDE for transferring at no charge. A teacher's guide is available from the Vocational Education Equity Program, also at the PDE. The series will not be available after September 30, 1983.